PowderMax 1 Powder Weighing Balance Enclosure

USER & SERVICE MANUAL

Esco SPW Manual Version 1.0 / Released 16 August 2006
Specifications subject to change without notice

WELCOME NOTE FROM ESCO

Congratulations! You have just purchased one of the finest powder weighing balance enclosures available.

It is a pleasure to welcome you to the exclusive club of our growing number of customers who, over the years have come to not just own and operate their Esco cabinets but treasure them too. For your convenience all exposed exterior and interior surfaces of this product has been wiped in a controlled clean environment.

Your new Esco PowderMax 1 Powder Weighing balance enclosure comes with a whole range of unique features and exciting new improvisations to simplify maintenance, enhance safety and improve ergonomics. These include:

- *User-friendly Sentinel™ microprocessor-based control and alarm system which simplifies operation and enhances user safety*
- *Transparent frameless acrylic front window and sides provide a high degree of visibility and operator comfort*
- *Energy efficient external rotor motor design which reduces operating costs and produces extremely low noise and vibration levels*
- *Chemical and abrasion resistant phenolic work surface*

Please read this manual to familiarize yourself with the procedures involved in the installation, basic operation and maintenance of the cabinet.

We recommend that this manual, together with the factory test report, be kept near the cabinet for convenient reference by operators and qualified maintenance personnel. If you have any questions that are not addressed in this manual, please do not hesitate to reach us by e-mail at ductless@escoglobal.com or give us a call at +65 65420833.

With warm regards from Singapore,

Lim Lay Yew
Chief Executive Officer

21 Changi South Street 1 Singapore 486777 Phone: +65 65420833 Fax: +65 65426920
Visit our website at ductless.escoglobal.com

TABLE OF CONTENTS

Safety Warning and Limitation of Liability 4
Declaration of Conformity 5
Freight Claim Information 6
Warranty Terms and Conditions 7
Corporate Profile Fume Filtration Division 8

A. USER SECTION

I. Basic Product Information **12**
1.1 Background **12**
1.2 Airflow Pattern inside the Cabinet **13**
1.3 Safety **14**
1.4 Performance **14**
1.5 Cleanability **14**
1.6 Operator Comfort **14**
1.7 Easy Servicing **15**
1.8 Cost Saving **15**
1.9 Testing **15**
1.10 In-House Tested **15**

II. Unpacking Your Cabinet **16**
2.1 Step-by-Step Procedure **16**
2.2 Packaging Contents **18**

III. Installing Your Cabinet **19**
3.1 List of Parts **19**
3.2 PW5 Assembly Guide **19**
3.3 Installation Location Requirement **24**
3.4 Installation Requirement – Extracts from BS 7258 ..... **25**
3.5 Case Study: Choosing the Best Installation Location **28**
3.6 Optional Retrofit Kits **29**
3.7 Installations **29**
3.8 Environmental / Electrical Condition **30**
3.9 Performance Validation **31**

IV. Operating Your Cabinet **32**
4.1 Sentinel® Control System **32**
4.1.1 Software Self-Reset **34**
4.1.2 Hardware Reset **34**
4.2 Menu Options **35**
4.2.1 Settings (Clock, Timer, and Units) **36**
4.2.2 Calibration **38**
4.2.3 Administrator Access and PIN **38**
4.2.4 Setting the Mode (Normal and Maintenance) **41**
4.3 Starting the Cabinet **42**
4.4 Working in the Cabinet **43**
4.4.1 Working Ergonomics **43**
4.5 Cleaning and Shutting Down the Cabinet **44**

V. Maintaining Your Cabinet **45**
5.1 Maintenance Schedule **45**

B. SERVICE SECTION

I. Maintenance by Service Personnel **47**

1.1 Airflow Verification and Cabinet Re-Certification **47**
1.2 Calibration of the Sentinel™ Control **49**
1.3 Software Updating **50**
1.4 Replacement of Filter **51**
1.5 Replacement of Fluorescent Lamp **52**

II. Product Specification **53**
2.1 Engineering Details **54**
2.2 Technical Specification **55**
2.3 Circuit Schematic (230V) **56**
2.4 Circuit Schematic (115V) **57**
2.5 Sentinel Control System **58**

III. Troubleshooting **59**
3.1 Electrical and Mechanical Troubleshooting **59**
3.2 Software Troubleshooting **64**

Copyright Information **65**

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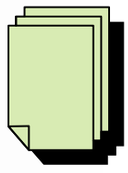
APPENDIX



Appendix A
Measurement of Face Velocity Test **67**
Appendix B
Reference Materials **69**

Defect Reporting Form **70**

SAFETY WARNING

- The use of any hazardous material in the cabinet must be monitored by an industrial hygienist, safety officer or some other suitably qualified individual.
- Explosive or inflammable substances should never be used in the cabinet unless a qualified safety professional has evaluated the risk involved.
- If radiological hazards are being used in the cabinet, additional protective measures should be taken. Besides that, the operation should be monitored by a suitably trained individual.
- Before you proceed, you should thoroughly understand the installation procedures and take note of the environmental/electrical requirements of the cabinet
- In this manual, important safety related points will be marked with this symbol
- If the equipment is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

LIMITATION OF LIABILITY

The disposal and / or emission of substances used in connection with this cabinet may be governed by various local regulations. Familiarization and compliance with any such regulation are the sole responsibility of the users of the cabinet. Esco's liability is limited with respect to user compliance with such regulations.

European Union Directive on WEEE and RoHS

The European Union has recently issued two directives: Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) and Directive 2002/95/EC on Restriction on the use of Hazardous Substances (RoHS).

WEEE: The objective of the WEEE directive is to promote "….*the reuse, recycling and other forms of recovery of such wastes (WEEE) so as to reduce the disposal of waste besides improving the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers….*" and hence this directive is relevant to the issue of disposal of this cabinet within the EU. As per this directive, a "wheelie bin" sticker (shown alongside) has to be pasted on all products which come under the purview of this directive, thereby indicating that at the time of disposing the particular product/equipment, it should not be grouped together with general unsorted municipal waste. Instead the directive mandates that distributors of electrical and electronic equipments be responsible for the collection and scrapping of the products they have sold. Please note that this cabinet has been classified as **"fixed industrial equipment"** and hence does **NOT** come under the purview of the WEEE directive. At the time of disposing this cabinet, you can still contact your local Esco distributor who would arrange for collection and recycling of this cabinet at a reasonable fee.

RoHS: With respect to the directive on RoHS, please note that this cabinet falls under category 9 (monitoring and control instruments) and is therefore **EXEMPTED** from requirement to comply with the provisions of this directive.

Declaration of Conformity *
In accordance with EN 45014:1998

CE

We, **Esco Micro Pte Ltd**
based at 21 Changi South Street 1
SINGAPORE 486777
Tel: +65 65420833
Fax: +65 65426920

declare on our sole responsibility that the product:

Equipment : Ductless Powder Weighing Balance Enclosures
Model : Esco Powdermax 1

in accordance with the following directives:

72/23/EEC : The Low Voltage Directive and its amending directives
89/336/EEC : The Electromagnetic Compatibility Directive and its amending directives

has been designed to comply with the requirements of the following Harmonized Standard:

Safety Standard : EN 61010-1 (2001)
EMC : EN 61326 (2002) Class B
Design/Performance Criteria:
- **ANSI / ASHRAE 110-1995**

More information may be obtained from Esco's authorized distributors located within the EU. A list of these parties and their necessary contact information is available on request from Esco.

Lim Lay Yew
Chief Executive Officer

* Applicable only to 220-240 VAC 50 Hz cabinets

FREIGHT CLAIM INFORMATION

Esco inspects each product for defects before shipment. Esco products are then carefully packed in compliance with carrier regulations and thoroughly inspected before leaving our plant. Responsibility for their safe delivery is assumed by the carrier upon acceptance of the shipment. However shipments occasionally do get damaged in transit. Claims for loss or damages sustained in transit must be made upon the carrier.

Please note that for each shipment you accept, you would be responsible for all freight claims and the cost of replacement of all damaged parts/items. So please inspect each shipment very carefully before accepting.

Carefully inspect each pallet or crate upon receipt. If a shipment is found to be damaged upon delivery, you are required to get the driver / carrier take note of the details of the damage on the delivery receipt. This is very important as your claim may be rejected otherwise. In case the pallets are found to be stacked, please leave a note saying "Stacked Pallets" on the delivery receipt. Note that pallets are not stacked at the time of being shipped out of our premises, unless otherwise stated for certain products. Esco is not responsible for pallets being stacked at carrier terminal. Any unloading difficulties or damages due to components being stacked are the responsibility of the carrier.

If freight damage is discovered, please refer to the following guidelines for effective processing of freight claim:

SHIPMENT WITH VISIBLE LOSS OR DAMAGE

- Any external evidence of loss or damage must be noted on the freight bill or delivery receipt and signed by the courier's agent or delivery driver
  NB: Failure to properly describe evidence of loss or damage may result in the carrier refusing to honor a claim
- Contact delivering terminal to arrange for a claim form and inspection report to be faxed or mailed to you
- Notify Esco Micro Pte Ltd regarding the items/parts that need to be replaced
- Keep all damaged items/parts and packaging material until claim is resolved between you and the carrier

SHIPMENT WITH CONCEALED LOSS OR DAMAGE

When any damage or loss is discovered during the course of unpacking:

- Contact the carrier immediately upon discovery of damage and request for inspection by the carrier's agent.
- Carrier will determine the need for inspection based on the value of the shipment and time elapsed
- Notify Esco Micro Pte Ltd regarding the items/parts that need to be replaced
- For claim purposes, Esco will fax to you an order acknowledgment that would include the prices of the damaged items (less freight cost)
- Esco will invoice you for replacement items/parts
- Esco standard payment terms will apply

REJECTION OF SHIPMENT

- If a shipment is received with substantial damages, you may refuse to accept the shipment in part or full. Do not unpack pallets or crates with damaged materials. Please note that individual items cannot be refused. You can either reject the entire pallet or accept the freight after noting down the damages (see above)

- Esco will handle all freight claim procedures and process a replacement order for your company for the damaged items/parts at no extra charge. (This is applicable only if the original order was shipped under CIF terms i.e. Esco had covered the insurance)

NOTE: Any correspondence with Esco regarding loss or damage must be accompanied by a copy of the shipping carrier's report. Esco will not accept returns that have not been authorized.

In the event of you accepting a damaged shipment, notification of loss or damage must be sent to the carrier within 10 days of receiving the freight. Notification outside the 10-day time frame may result in shipping damage claim being rejected.

WARRANTY TERMS AND CONDITIONS

Esco warrants that this equipment will perform according to the specifications for 1 year from the date of purchase. With certain exceptions***,** this 1 years warranty applies to all parts and components of this equipment

Esco's liability under this warranty shall be limited to repair or replacement of the equipment at Esco's option. Under no circumstances shall Esco be liable for the equipment damage arising out of or in any way connected with the failure of the equipment to perform as set forth herein. This limited warranty is in lieu of all other expressed or implied warranties, including those of merchantability and fitness for a particular purpose.

In the event of any defect, malfunction or breakdown being detected during the warranty period, Esco will repair or replace, at its option, the product or component therein which upon examination by Esco shall appear to be defective, or not up to factory specifications. The purchaser must pay any transportation or labour expenses incurred in removing and returning the product to the service centre.

Esco would not be responsible for the cabinet's malfunctioning or any sort of damage to people or property arising out of non-compliance with the operating instructions laid down in this manual, poor maintenance or improper use of the cabinet.

This warranty shall not apply to any Esco product or part thereof which has been subject to misuse, abuse, accident, shipping damage, improper installation, unauthorized servicing and testing, damage by fire / flood, or acts of God. If the serial number of this product is altered, removed or defaced as to be illegible, the warranty shall be null and void in its entirety.

The use of non-Esco parts and/or parts not supplied directly by Esco or our authorized distributors, including but not limited to maintenance parts, spare parts, replacement parts, system components and/or system accessories, shall void all expressed or implied warranties.

To obtain warranty service, the defective product or part(s) must be returned to Esco or an authorized Esco Factory Service Centre along with a proof of purchase. ***It is mandatory for the customers to register receipt of their equipment online with Esco at http://www.escoglobal.com/warranty. Alternatively, the user can also complete the warranty registration form which can be found within this manual.***

Please take note that when returning the defective product or part(s), you must first obtain a return authorization (RA) number from Esco and it must be noted on the documents accompanying the return. **The defect reporting form can be found in this manual**.

** The 1 year warranty doesn't apply to consumable parts viz. filter, light tubes, pre-filters.*

CORPORATE PROFILE – FUME FILTRATION DIVISION

A History of Clean Air Device Manufacturing

The emergence of new high-tech industrial and life sciences industries in the late 70's opened opportunities for development of clean air solutions. We were among the earliest to spot this opportunity. Esco was thus founded in 1978 to pioneer development in this exciting new field of clean air technologies. Soon after, leveraging on our strengths in clean air technology, we ventured into the construction of laminar flow clean air devices.

By the early 80's, we had

already designed biohazard safety cabinets - today a core offering of Esco Biotech - and fume hoods. Manufacturing of these products were also undertaken simultaneously. This greatly helped us in broadening the base of our core competencies to encompass containment technology. By then, Esco had emerged as the first local company to export indigenously developed and credible clean air products. To further build on our strengths, Esco established a sheet metal fabrication facility in 1985.

Esco Fume Filtration

The Esco Fume Filtration Division is a highly focused manufacturer of ductless fume cabinets and other carbon-filtered enclosures designed for the containment of hazardous chemical vapours in the laboratory.

Our products comply with the latest international standards for both containment and filtration efficacy such as the American Standard ASHRAE 110. Esco is unique in being the first and only Asian manufacturer of carbon filtered enclosures which have been independently tested and certified. Our state-of-the-art in house testing capabilities for both containment and filtration efficacy have also been independently accredited.

Esco offers one of the widest ranges (more than 7 types) of carbon filtered enclosures in the industry and are carefully matched to the user's application to ensure safety. When this process is complete, the user can enjoy the benefits of carbon filtration (ductless) technology including mobility, energy-savings and no installation costs.

Today Esco is helping a whole gamut of high-tech industries keep their products, people and processes free from contamination.

Be it our Cleanroom construction components that help pharmaceutical majors meet GMP standards for producing drugs in a clean environment; or our laminar flow mini-environments that help microelectronics manufacturers enhance their product reliability and yields; or for that matter our safety cabinets that help researchers conducting clinical biological research in developing vaccines for dangerous diseases – Esco is making its own humble contribution in a wide range of critical fields that in turn help in making a difference to our day-to-day lives.

With sales in over 70 countries, we have fully geared ourselves for the international marketplace. In our single minded pursuit for customer satisfaction, we have developed a well knit network of international distributors and partners, who provide quick, responsive and localised service and support for our products.

Sophisticated Production Capabilities

Today Esco's production work is carried out at a state-of-the-art centralized facility measuring 3,900 m^2 (42,000 sq. ft). Based in Bintan, Indonesian, this facility is highly automated to ensure that all products adhere to the highest quality standards and production involves minimal human intervention. CNC (Computer Numerically Controlled) sheet metal machinery is the pride of the facility. An advanced powder-coating process has also been incorporated in the facility to provide an aesthetic finish to all the laboratory equipment produced at the facility. We have always been careful not to sit complacently on our laurels and are strongly committed to continuously investing in cutting edge of fabrication technologies.

World-Class R & D

At Esco, we understand that being at the cutting edge of technology is the key to our survival. Hence continuous investment in Research and Development (R&D) is the mainstay of our corporate policy. Currently, one in every two non-production staff at Esco serves in a R&D position. This is a further demonstration of how seriously we take our R&D.

Most of our R&D is carried out at the *Esco Fume Filtration Technology Centre* located at our corporate headquarters in Singapore.

This centre features a demonstration laboratory, conference/training facilities for visitors, and various testing laboratories in which state-of-the-art research and tests are continuously conducted in order to improve the performance of our products. The laboratories are equipped with a formidable array of latest instruments - properly calibrated and maintained. Included among them are particle counters, air velocity meters, flow visualization devices, electrical safety analysers, and light/noise level/vibration meters.

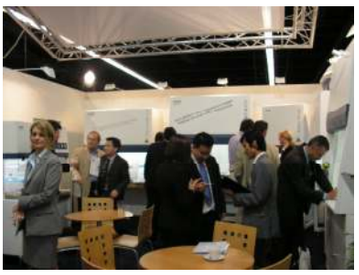
ISO 9001 Quality Management System

At Esco, quality and customer satisfaction are our top priorities, which is why the company operates under an ISO 9001 certified quality management system. Extensive quality control and testing, carried out at every stage ensures that we deliver nothing but the best to our customers.

ISO 14001 Environmental Management System

Esco also practices responsible corporate citizenship by demonstrating a firm commitment to the environment. Many of our products are designed to be extremely energy efficient, while our cabinets are produced using easily recyclable steel.

Geared for Global Marketplace



Esco regularly participates in numerous major international, regional and national industry trade shows and exhibitions.

USER SECTION

CHAPTER I

BASIC PRODUCT INFORMATION

Powder Weighing Balance Enclosures provide user protection by keeping powders and particulates contained during weighing procedures. They are suitable for most common chemical work (Note that ductless cabinets are NOT suitable for all chemical application. Please consult Esco for advice concerning your individual application). The Esco PowderMax 1 Powder Weighing Balance Enclosure is our new-improved product which offers the best combination of performance, quality and cost-effective in the market today.

1.1 BACKGROUND

The safety of personnel in the laboratory has always been of significant importance. Therefore, it is important to ascertain the ability of the technology to provide a safe solution in the laboratory.

Powdermax 1 Powder Weighing Balance Enclosure provides safety to laboratory personnel by drawing air across a front opening in the hood at a controlled rate, thus preventing any powders or particulate matters generated during the experimental procedure from escaping into the general laboratory environment.

It is an ideal workstation to protect researchers, lab technicians and production workers when weighing, measuring, pouring, mixing and performing all the process operations that may involve dust, particulates, and powders.

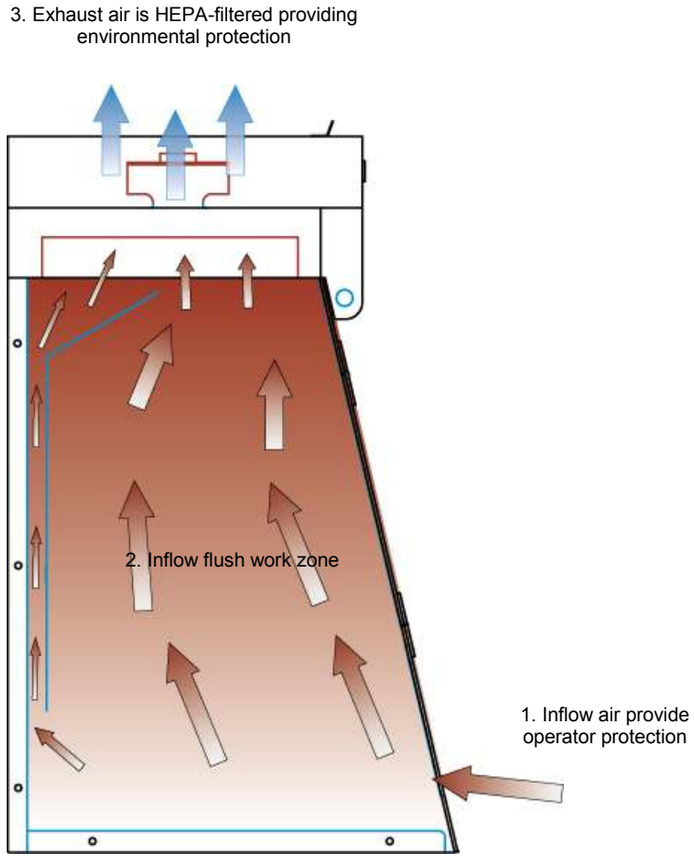
In order to gain a better understanding of their benefits, let us examine how these hoods filter out particulates, organic fumes generated during weighing procedures conducted in the laboratory. Esco's Powdermax 1 Powder Weighing Balance Enclosures incorporate a state-of-the-art HEPA filter system, which is rated at least 99.99% efficient for 0.3micron sized particles. HEPA filter is the primary filtration component in removing all powders and particulates from within the enclosure.

Each enclosure will effectively contain toxic particulates when properly installed and operated. The interior dimensions can easily accommodate large micro and analytical balances. And it allows full access to balance while keeping the effects of drafts and air movement to bare minimum for highly accurate weighing.

Personnel protection is provided in a manner similar to conventional fume hoods by drawing air at a controlled rate across a front opening into the hood. Ductless cabinet has many advantages over conventional fume hoods:

- Fully installed systems ready to operate are available at a lower cost than bulky conventional fume hoods.
- An expensive ducting and external blower system that is often difficult to maintain is not required.
- They are mobile and can be relocated easily to meet your changing needs; perfect for schools and education institutes.
- They allow energy saving since air which is costly to air condition or heat is not removed from the laboratory.

1.2 AIRFLOW PATTERN INSIDE THE CABINET


3. Exhaust air is HEPA-filtered providing environmental protection
2. Inflow flush work zone
1. Inflow air provide operator protection

1. An inflow air curtain from the ambient environment into the cabinet with an average velocity of 0.4 m/s or 80 fpm is induced by the cabinet blower system.

2. The inflow flushes the entire work zone of the cabinet; within the main chamber of the cabinet; negative pressure (relative to the ambient environment) is maintained in order to ensure that no chemical powders or particulates escape the work zone.

3. Air is taken through HEPA filter mounted in the interior; this removes all fumes from the exhaust air stream; exhaust air is re-circulated directly back to the room from the top of the cabinet

1.3 SAFETY

At Esco, your safety is of paramount importance to us. Thus Esco PowderMax 1 Powder Weighing Balance Enclosure has been packed with features that would take your safety to an altogether new level. A highlight of these features is as follows:

- A unique filter mounting system that eliminates bypass leaks inherent in conventional clamping system
- A generously-sized filter with higher chemical retention capacities
- Microprocessor-based control system provides the user with numerous safety and operational features, ensuring an enhanced safety in the laboratory
- Isocide™ Antimicrobial coated cabinet structure prevents surface contamination and inhibits bacterial growth on the cabinet's external surfaces.
- State-of-the-art baffle design to ensure better airflow uniformity and distribution within the cabinet for better operator protection

1.4 PERFORMANCE

The cabinet is precisely engineered to deliver the required performance anytime you need it

- As the filter loads, the intelligent blower system automatically adjusts itself to maintain constant airflow. This unique feature eliminates the need for constant speed control adjustments, thereby ensuring optimum performance
- Sentinel microprocessor control system monitors all critical cabinet airflow parameters and alerts the operator through audible/visual alarms in case of any malfunction. Airflow sensors employed are temperature-compensated
- Temperature compensation leads to improved accuracy of airflow sensor.

1.5 CLEANABILITY

The issue of cleanability is important to ensure easy procedures

- Removable phenolic worktop

1.6 OPERATOR COMFORT

The features incorporated in this cabinet allow for greater operator comfort and better working condition:

- 13-degree sloped front allows easy access to work zone – enhancing ergonomics, eliminating operator fatigue and increasing productivity
- Curved front edge minimizes airflow turbulence and improves user comfort
- Transparent frameless acrylic front window and sides provide a high degree of visibility and operator comfort; front window is mounted on self-supporting pre-tensioned hinges, allowing for easy access during cabinet loading and start-up
- 2 electrical outlets at the back wall, providing a convenient power source for equipment to be used in the cabinet
- Electronic ballast for fluorescent lighting results in lower heat output, higher energy efficiency, increased reliability / service life and most importantly zero-flicker.

1.7 EASY SERVICING

We design the cabinets in such a way that the number of people required for servicing them is minimal, besides ensuring that the downtime is as short as possible.

- Easy filter access through the front part of the cabinet for minimized downtime
- Comfortable grip position for filter
- Blower maintenance on top cover access
- Each cabinet is supplied with a convenient hand tool kit and extra fasteners
- Blower Hour Meter to help the user monitor total cabinet usage. Every 60 hours, the control system reminds the user to test the exhaust concentration with gas detection tube to see whether the filter is saturated.

1.8 COST SAVING

Esco uses the permanently lubricated direct drive centrifugal blowers which employ an energy-efficient external rotor type design. This helps Esco cabinets deliver excellent performance while keeping the operating cost low at the same time.

1.9 TESTING

Before being shipped, each individual unit is extensively tested for performance and safety and delivered with a detailed test report and certificate of performance. Testing performed at our factory laboratory includes:

- Operator comfort tests: noise, light, vibration
- Filter efficiency
- Electrical safety to IEC61010-1

Additional units are also randomly selected on a statistical sampling basis and re-tested using research-grade instrumentation and additional test protocols at our dedicated Product Development Laboratory.

1.10 IN-HOUSE TESTED

The Esco Powdermax 5 Powder Weighing Balance Enclosure has been tested in-house for compliance with ANSI/ASHRAE 110-1995 requirements.

Please refer to chapter 2 of Section B (SERVICE SECTION) for detailed product specification.

CHAPTER II
UNPACKING YOUR CABINET

This chapter aims to provide relevant information on how to handle the cabinet properly upon receipt. Failure to follow the following instructions may cause damage to the cabinet. We strongly advise you to read this chapter carefully before proceeding further. Relevant information on **Warranty Terms and Conditions can be found on page 7.**

2.1 STEP-BY-STEP PROCEDURE

1. Inspecting the corrugated cardboard box

   Upon receipt of your new cabinet, inspect the cardboard box. If there is any visible damage to the exterior of the box please refer to **freight claim information on page 7**.

2. Moving the cardboard box

   a. The corrugated cardboard box has been designed to protect your cabinet from external impact. However, excessive impact on the box may damage the cabinet too. Hence all care should be taken to protect the box from direct impact during the course of moving it.

   b. While lifting and moving the box, please ensure that the floor jack or mechanical lift truck has entered fully under the box so that the box can be lifted stably. Otherwise there would be a risk of the box falling off from the floor jack or mechanical lift truck during handling. Whenever needed, please use suitably long extension bars.

   c. While the box is being moved, there should be adequate gap between the ground and supports of the pallet. The pallet should not be dragged on the ground as it would damage the pallet and possibly the cabinet too.

3. Removing the strapping

   a. Remove the strapping by cutting it

   b. Do not discard the packaging material of your cabinet until you have fully installed and tested the unit along with all its components.

4. Opening the box

   a. If the unit is bundled with a support stand, you would find it strapped on top of the main cabinet box, and onto the pallet.

   b. Unwrap the protective plastic wrapping which covers the main box and the support stand box (if present)

   c. If straps are present, cut them now.

   d. Open the top cover of the box by cutting the masking tape

5. Removing the packaging material

   a) The cabinet is packed unassembled protected by styrofoam

   b) Remove the styrofoam to unload different sections of the cabinet

   c) If you find any damage during this stage of unpacking please refer to **freight claim information on page 7.**

For the cabinet to deliver optimal performance, it is very important to place it at the most suitable location. There are a lot of factors that determine the location best suited for the cabinet. Please refer to the next chapter for guidelines.

6. Install the cabinet on the existing work surface

While installing the cabinet onto an existing work surface, ensure that the structure can safely support the combined weight of the cabinet and any related equipment. Some modifications to the work surface may be necessary.
The work surface should be smooth, nonporous and resistant to those disinfectants and chemicals, to which the cabinet is regularly exposed.

Esco Micro is committed to protecting the environment. Please re-use the pallet as far as possible and /or dispose off the packaging material and box in an environmentally responsible manner. Please hammer any exposed nail/sharp projection on the box's surface prior to disposal.

2.2 PACKAGING CONTENTS

The following items are included along with your manual:
1) Test certificate
2) Test report
3) 1 bag containing spare fasteners
4) 1 M4 and 1 M8 spanner screwdriver for maintenance and service
5) 1 yellow screwdriver for adjusting the speed control

The following items are permanently attached to the cabinet in a Ziploc bag:
1) Test report
2) Electrical diagram

In case this manual and/or test report are lost or misplaced, you have little to worry about. Esco retains a copy of the same. At any time, you may obtain a replacement copy by contacting Esco Micro Pte Ltd and stating the cabinet model, serial number and a brief description of the information you are seeking.

CHAPTER III
INSTALLING YOUR CABINET

3.1 List of Parts

The following parts are included in your packaging:

No.	Parts	Quantity
1.	Main Panel	1 piece
2.	Baffle Board	1 piece
3.	Back Panel	1 piece
4.	Front Perspex	1 set (3 pieces)
5.	Side Perspex	1 set (2 pieces)
6.	Fixture Hole Cover	2 pieces
7.	Phenolic Worktop	1 piece
8.	Plastic Thumb Screws	14 pieces
9.	M4 Pan Head Screws with Washer	2 sets
10.	M8 Hexagonal Nut with Washer	6 sets

3.2 SPW Assembly Guide

1. Attach the Side walls (left and right side) to the back panel by using
   -M8-6 White plastic screws.

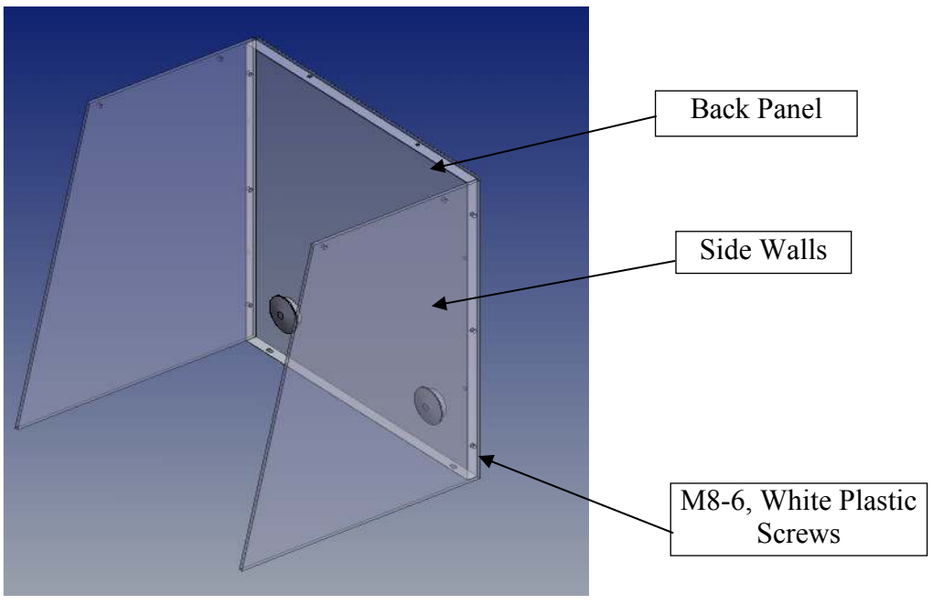


FIGURE A

2. Place the Baffle as shown in FIGURE B and attach it to the Back Panel by using:
   - M8 - 4, metal screws

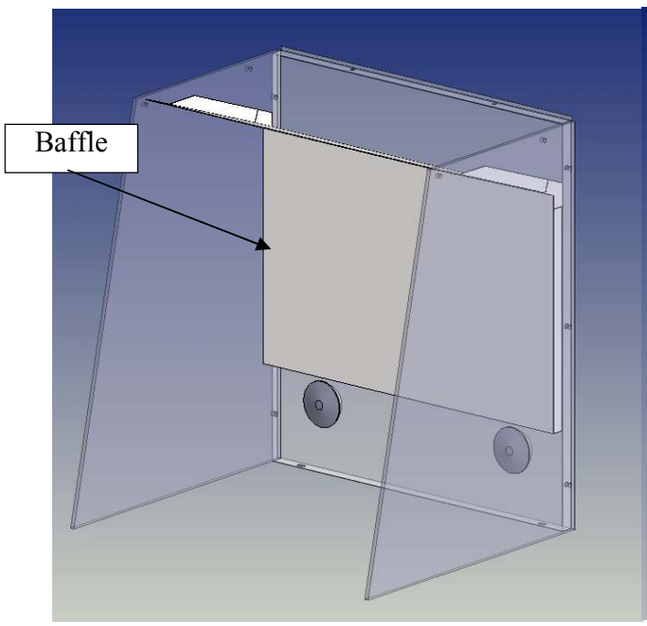


FIGURE B

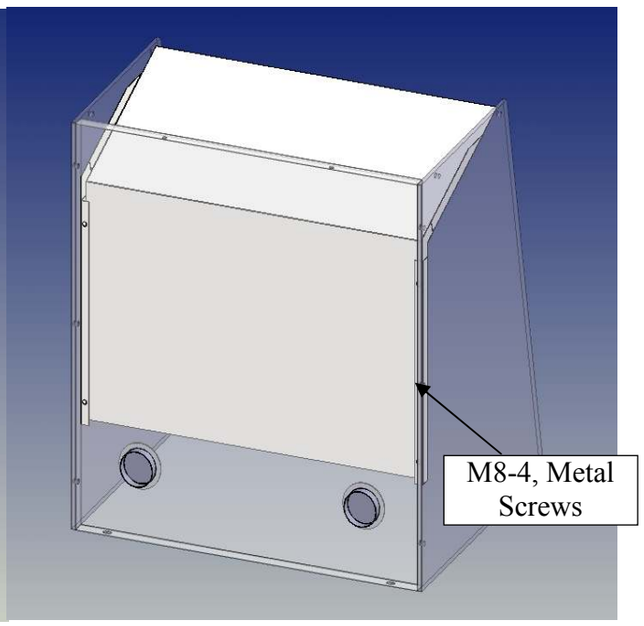


FIGURE C

3. Attach the Tabletop to the Sidewalls by using:
 - M8 – 4, White Plastic Screws

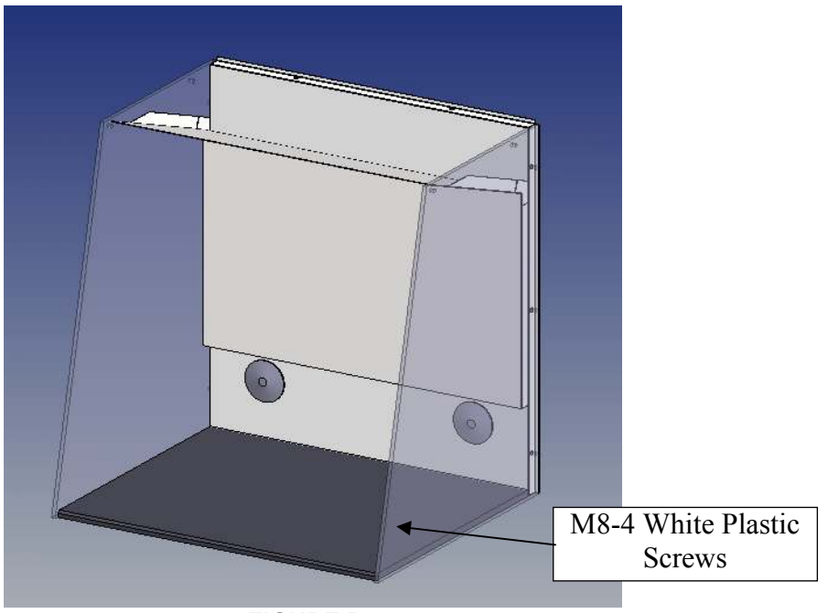


FIGURE D

4. Assemble the Top Panel to the Back Panel by using:
   -M8-4 White Plastic Screws for Top Panel to Sidewalls (Left and Right Side)
   -M8-2 Metal Screws for Top Panel to Back Panel

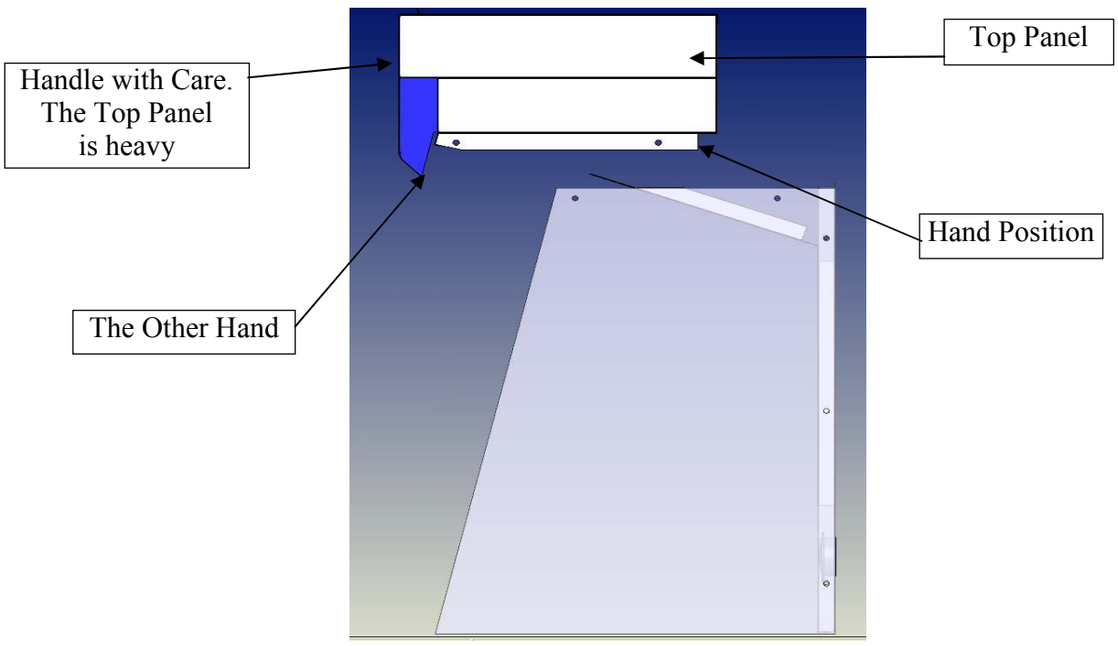


FIGURE E

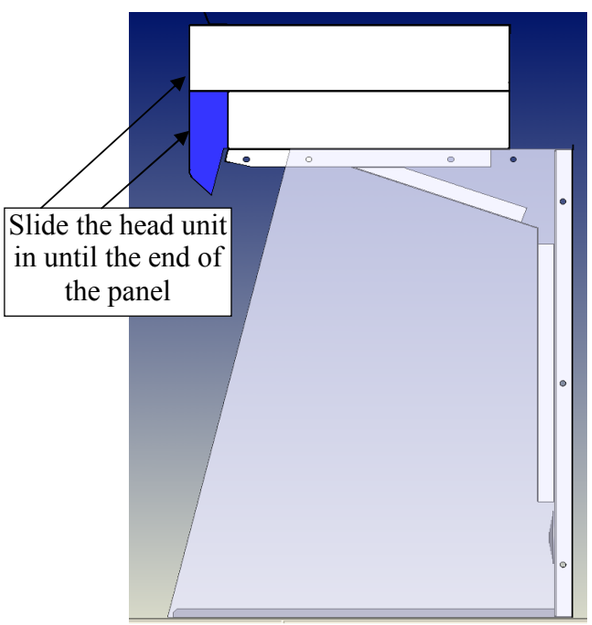


FIGURE F

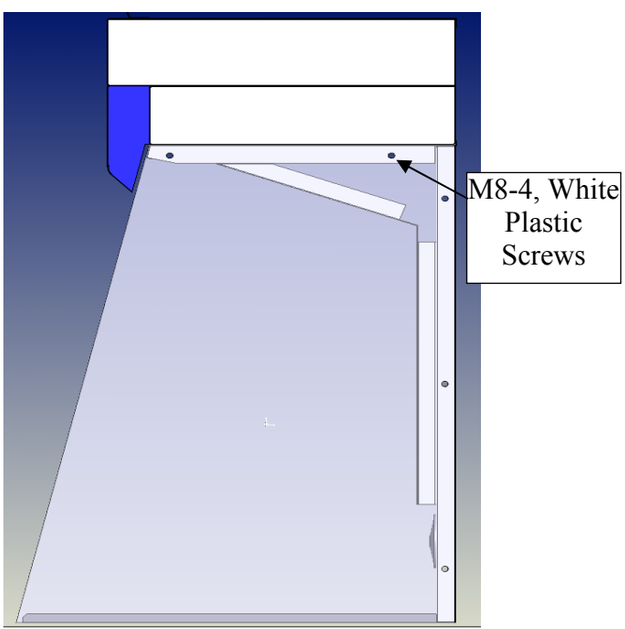


FIGURE G

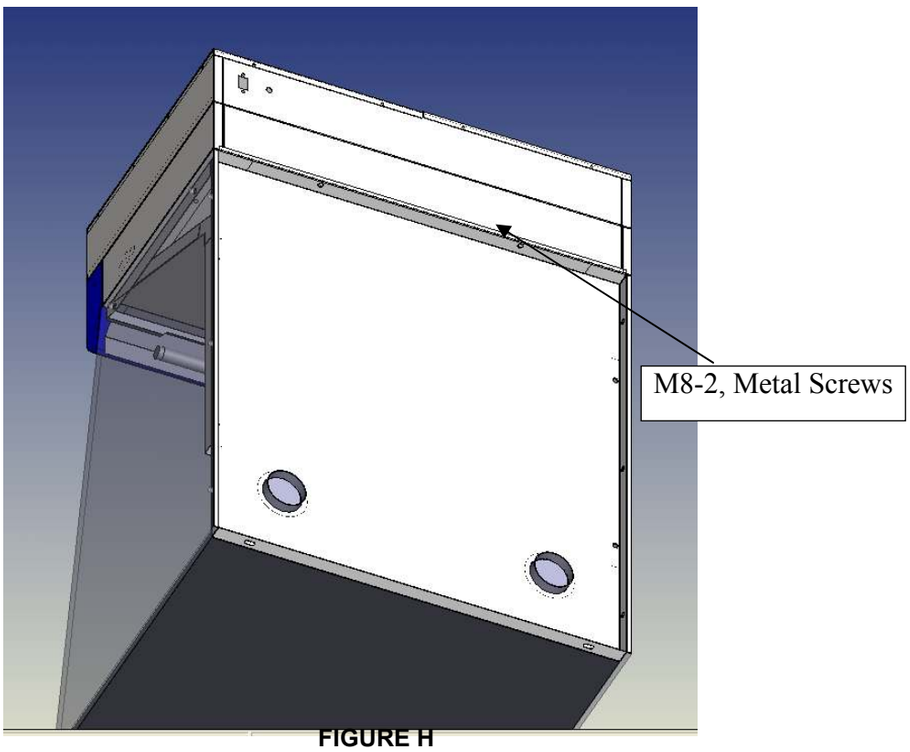


FIGURE H

5. Attach the Front walls to the main cabinet by using:
   - M4-2 metal screws

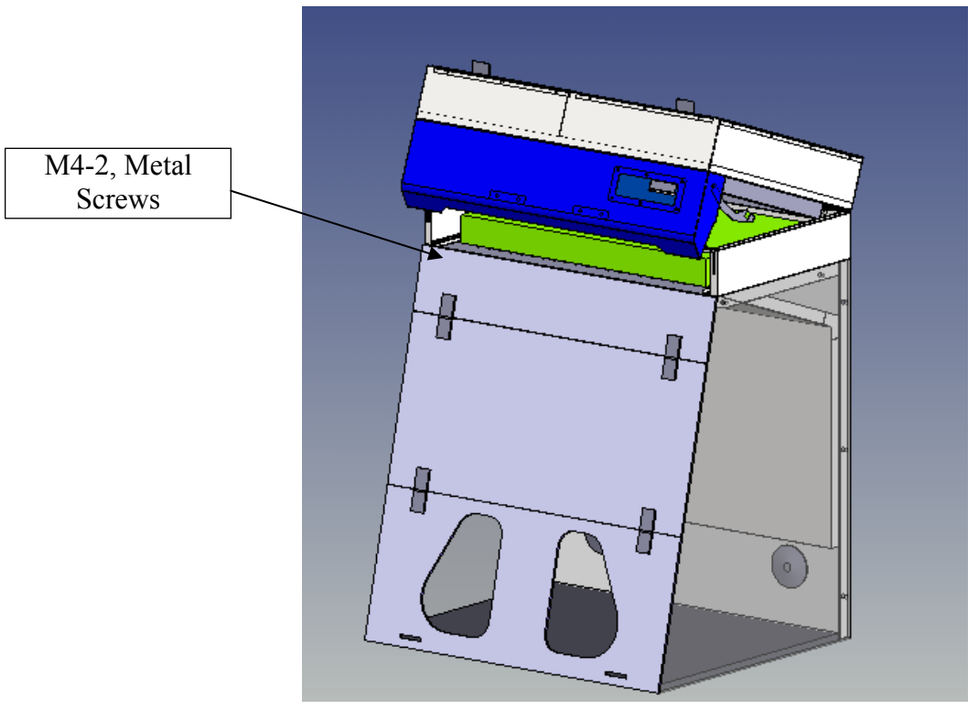


FIGURE I

6. The FIGURE J shows the final end product

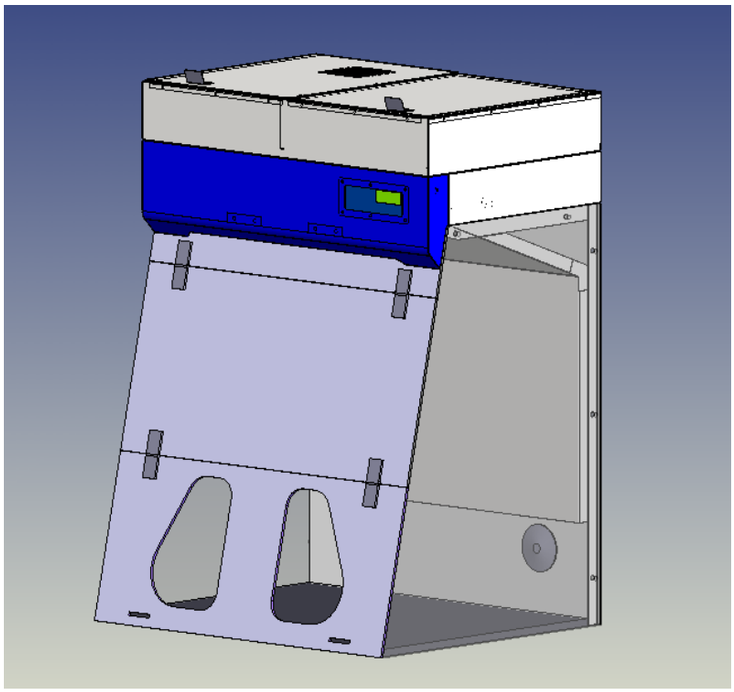
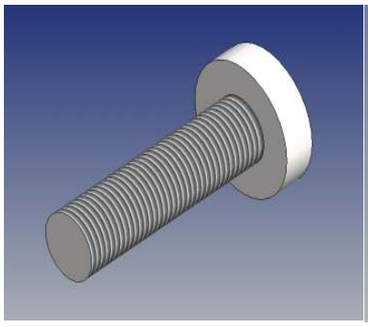
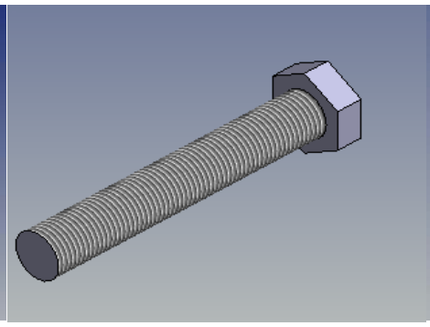


FIGURE J

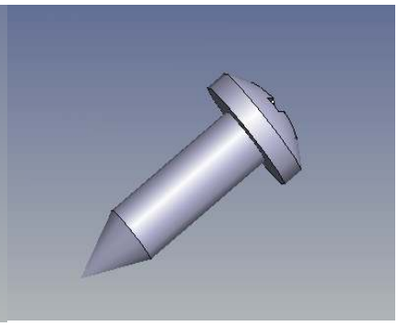
The type of screws used:



M8- White Plastic Screws



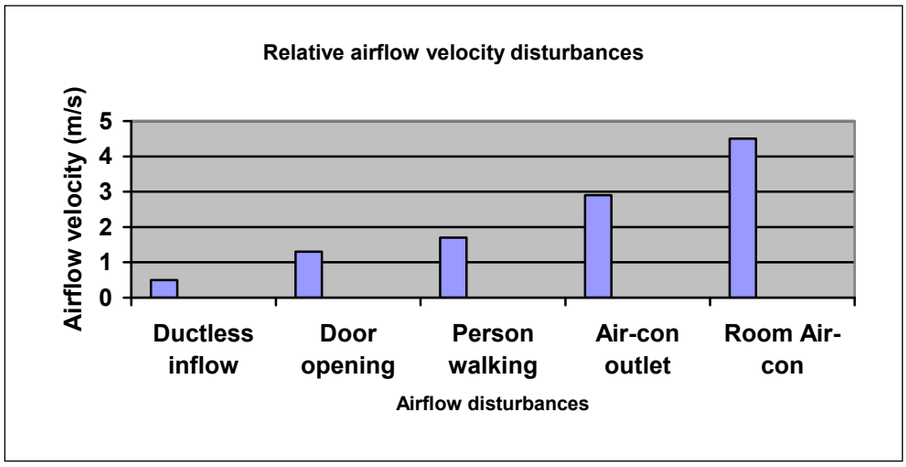
M8- Metal Screws



M4- Metal Screws

3.3 INSTALLATION LOCATION REQUIREMENT

Installation location of the cabinet has a big impact on its overall performance. Installing the cabinet at a location where it is likely to be exposed to a lot of external airflow disturbances might lead to loss of containment. As can be seen in the graph below, your cabinet's internal airflow velocity is relatively small compared to the airflow disturbances potentially caused by opening of a door, a person walking by or for that matter being exposed to an air-conditioning outlet. All these things can therefore affect the proper functioning of a bio-safety cabinet, thereby impairing the protection offered by the cabinet to both the operator and the samples placed inside it.



Therefore while installing the cabinet, it should be located as far away as possible from the above-mentioned sources of airflow disturbance and in an orientation which optimally shields the cabinet's internal airflow from all external airflow disturbances. Besides, the cabinet should not be placed close to another cabinet.

Please refer to the extracts from *British Standard BS 7258- PART 2:1994* (printed with permission) in section 3.4 for more details on how to select a proper location for your cabinet. Other factors that need to be observed during installation include:

3.1.1 There should be adequate space left for cleaning the back of the cabinet and for carrying out decontamination procedure.

3.1.2 The location should be far away from any kind of heat source (heaters, fan converters etc.) for facilitating optimum operating conditions. Please refer to the environmental/electrical conditions on the next page for more detailed information

3.1.3 There should be unobstructed access to the main power supply point.

3.4 INSTALLATION LOCATION EXTRACTED FROM BS 7258

The following article is Esco recommendation extracted from *British Standard BS 7258- PART 2:1994:*

To avoid disturbances to the fume cabinet and its operator, consideration should be given to the following:

a) The distance from the plane of the aperture to any circulation space should be at least 1000 mm, so as to preserve a zone undisturbed by anyone other than the operator – see figure 1a.

b) The distance between the front aperture and a bench opposite it should ideally be at least 1500 mm – see figure 1b. However, containment performance is not likely to be affected if this distance is reduced, for instance to enable an operator to use the bench behind whilst working at the cabinet. In this case operator movement over a smaller distance may cause less air disturbance. With such procedures their effect on containment should be measured by relevant operator protection factor tests.

c) There should be no opposing wall (or other obstruction likely to affect the airflow) within 2000 mm of the front aperture – see figure 1c.

d) Cabinets should not be installed in positions where they are likely to be affected by other items or equipment. In particular the distance to the aperture of an opposing cabinet, or the edge of a local exhaust ventilation outlet should be not less than 3000 mm – see figure 1d.

e) Any room air supply diffuser should not be within 1500 mm of the front aperture. If there are large numbers of safety cabinets in a laboratory this recommendation may be difficult to comply with, but where diffusers have to be placed in close proximity to a cabinet, their discharge velocities and therefore air handling rates will need to be low.

f) A cabinet should not be positioned with either side closer than 300 mm from a wall or similar obstruction – see figure 1e.

g) Large obstructions (e.g. and architectural column) projecting beyond the plane of the aperture should not be within 300 mm of the side of the fume cabinet – see figures 1f and g.

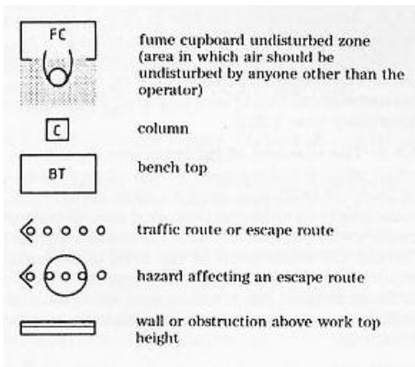
h) Doorways should not be within 1500 mm of the aperture or within 1000 mm of the side of the fume cabinet – see figure 1h – except where a door includes air transfer grills in which case protection factor testing should be carried out to ascertain a suitable distance.

The position of a cabinet should satisfy the spatial requirements (e.g. vision, lighting and convenience of access) of the operator and personnel working nearby. When a cabinet is installed on a bench top, the leading edge should be flush with or slightly overhanging the edge of the bench top.

Note 1: Typical problems and their solutions are illustrated in figure 2.

Note 2: There should not be an open space between the leading edge of the cabinet and the front of the bench as this may create turbulence in front of the aperture. It also provides an obstacle which could adversely affect airflow across the cabinet face.

Key to figures 1 and 2


FC
fume cupboard undisturbed zone (area in which air should be undisturbed by anyone other than the operator)
C
column
BT
bench top
traffic route or escape route
hazard affecting an escape route
wall or obstruction above work top height

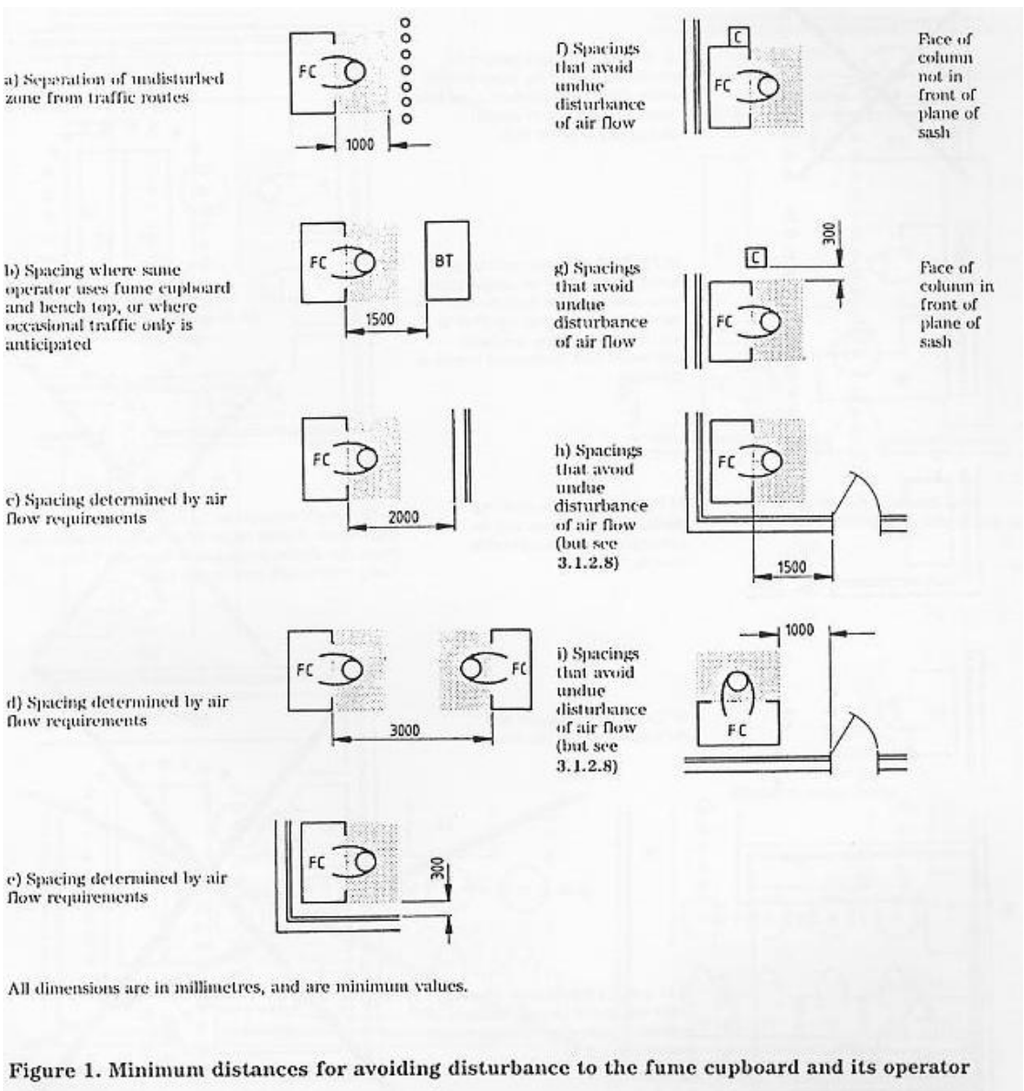
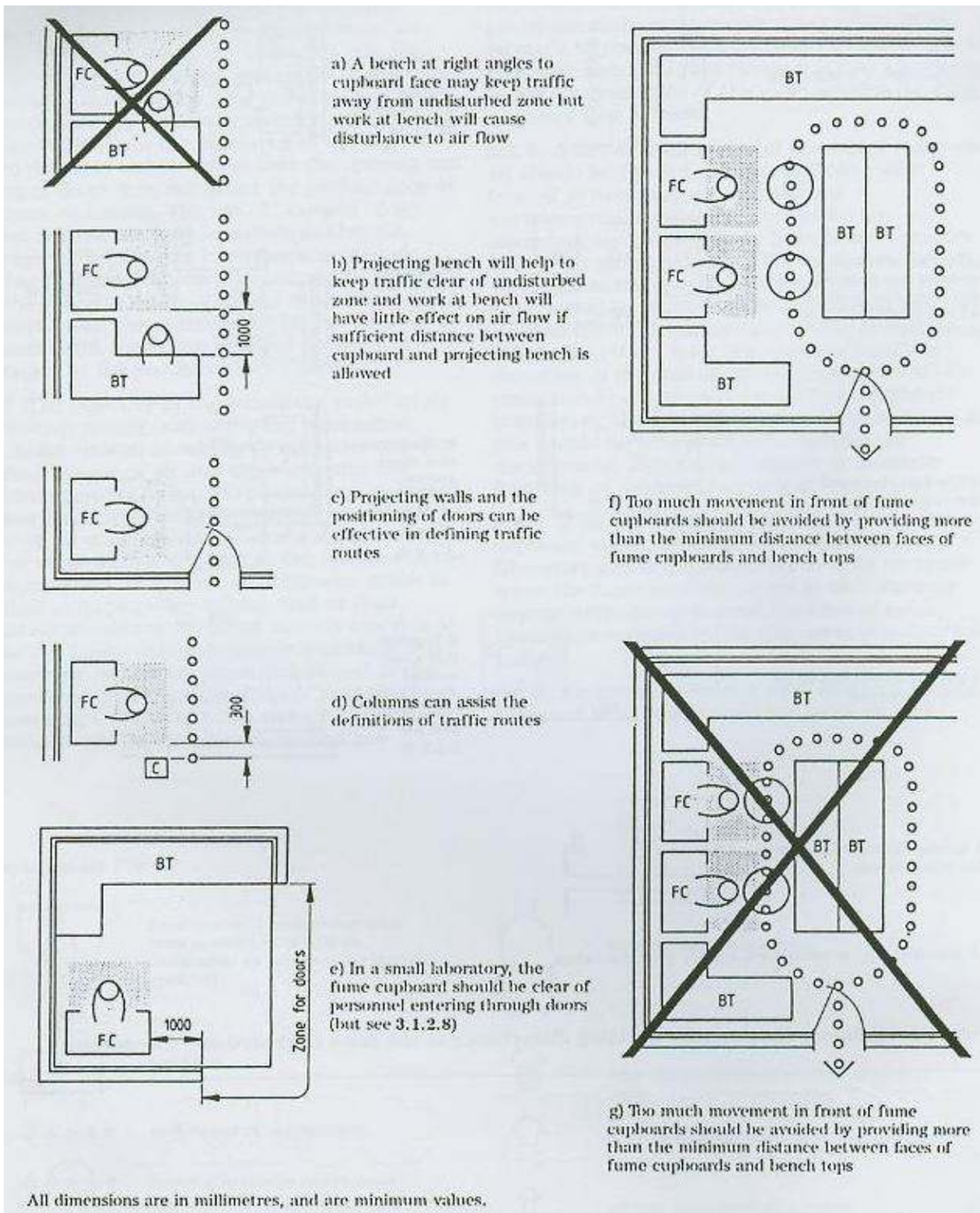

a) Separation of undisturbed zone from traffic routes
FC
1000
b) Spacing where same operator uses fume cupboard and bench top, or where occasional traffic only is anticipated
FC
BT
1500
c) Spacing determined by air flow requirements
FC
2000
d) Spacing determined by air flow requirements
FC
FC
3000
e) Spacing determined by air flow requirements
FC
300
f) Spacings that avoid undue disturbance of air flow
C
FC
Face of column not in front of plane of sash
g) Spacings that avoid undue disturbance of air flow
300
C
FC
Face of column in front of plane of sash
h) Spacings that avoid undue disturbance of air flow (but see 3.1.2.8)
FC
1500
i) Spacings that avoid undue disturbance of air flow (but see 3.1.2.8)
1000
FC
All dimensions are in millimetres, and are minimum values.

Figure 1. Minimum distances for avoiding disturbance to the fume cupboard and its operator


FC
BT
a) A bench at right angles to cupboard face may keep traffic away from undisturbed zone but work at bench will cause disturbance to air flow
FC
BT
1000
b) Projecting bench will help to keep traffic clear of undisturbed zone and work at bench will have little effect on air flow if sufficient distance between cupboard and projecting bench is allowed
FC
c) Projecting walls and the positioning of doors can be effective in defining traffic routes
FC
300
C
d) Columns can assist the definitions of traffic routes
BT
FC
1000
Zone for doors
e) In a small laboratory, the fume cupboard should be clear of personnel entering through doors (but see 3.1.2.8)
BT
FC
FC
BT
BT
BT
f) Too much movement in front of fume cupboards should be avoided by providing more than the minimum distance between faces of fume cupboards and bench tops
BT
FC
FC
BT
BT
BT
g) Too much movement in front of fume cupboards should be avoided by providing more than the minimum distance between faces of fume cupboards and bench tops

All dimensions are in millimetres, and are minimum values.

Figure 2. Planning arrangements for avoiding disturbance to the fume cupboard and its operator from other personnel

3.5 CASE STUDY: CHOOSING THE BEST INSTALLATION LOCATION

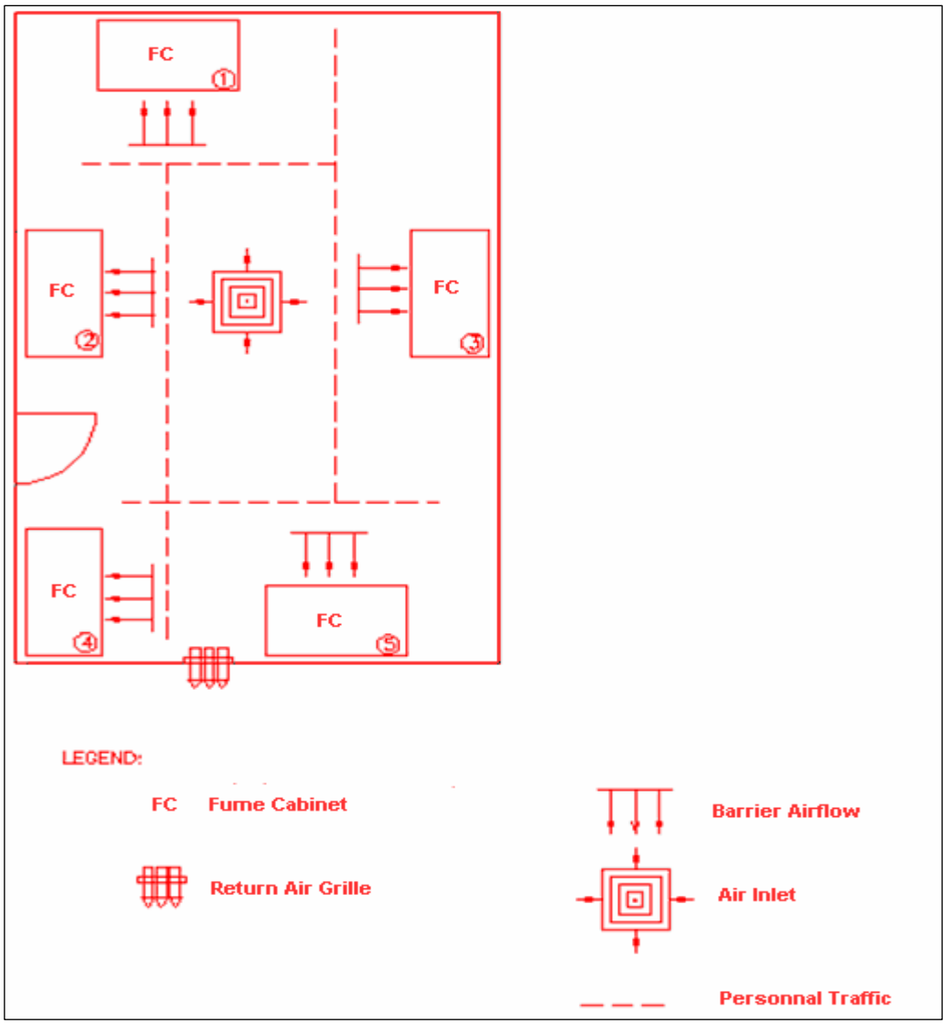


Fig. 5: Examples of the influence on cabinet airflow from room design and ventilation

1. Cabinet 1 is quite appropriately located with respect to avoidance of excessive air movements from surrounding areas
2. Cabinet 2 is too close to the doorway and its airflow could be influenced by the air inlet too
3. The airflow of cabinet 3 could also be influenced by the air inlet
4. Cabinet 4 is too close to the doorway.
5. Cabinet 5 is suitably located provided that the adjacent return air grille does not influence cabinet airflow.

Figure 5 illustrates various possible influences that can be induced by a room's design and ventilation system on the cabinet's airflow. Please note that Figure 5 does not depict any typical installation. In fact it is NOT recommended that so many cabinets be placed in a small room, or in close proximity to each other.

3.6 OPTIONAL RETROFIT KITS

1. Cabinet is available with a transparent glass back-wall, ideal for classrooms and educational demonstrations

2. Optional exhaust collar for exhaust ducting of PowderMax 1 Powder Weighing Balance Enclosure cabinets

3. Further customization is available upon request

3.7 INSTALLATIONS

1. Pay attention to **Section 2.1 (Step 7)** which contains guidelines on how to safely lift and move the cabinet.

2. Inspect your cabinet carefully. Should you find any defects, please refer to the **Freight Claim Information on page 7** and our **Warranty Terms and Conditions on page 8.**

3. Wipe the interior and exterior of the cabinet with water or a mild household detergent.

4. Connect the cabinet to the main power supply. The fan is automatically switched on. PLS CHECK PANEL message is displayed; please check that all LEDs and buzzer are on for 6 seconds. Leave the blower on for 3 minutes (default warm-up time is 3 minutes; this setting can be changed though – refer to **section 4.2.1.2**).

5. **Each cabinet requires a dedicated 4A (230V) or 11.5A (115V) power socket which should not be shared with other appliances. For some cabinets which require 2 power sockets - one for the power outlets in the work zone (auxiliary power outlet) and the other for the cabinet blower and electrical systems - 2 separate and dedicated power outlets should be used.**

3.8 ENVIRONMENTAL/ELECTRICAL CONDITIONS

This cabinet has been designed to be used under the following conditions:

ENVIRONMENTAL

1. Indoor use
2. Altitudes of up to 2000 meters (6600 ft)
3. 20% - 60% relative humidity
4. Temperature should be in between 20 degree C and 30 degree C (68 deg F and 86 deg F).
   NB: It is recommended that the temperature in the laboratory be maintained within a +/-2 degree C range under all conditions
5. Pollution Degree * : 2.0

ELECTRICAL

1. Installation Category ** : II
2. It is also recommended that the voltage does not fluctuate by more than +/- 2% of the nominal voltage at any given time. Otherwise an electrical power stabilizer should be installed.
3. Electrical surge protector & back-up power supply (UPS) is strongly recommended for better protection. If UPS is not used and there is a power failure, the operator would have to take immediate measures to safeguard against any possible incidence of containment failure.
4. There should be unobstructed access to the main power plug on the power cord.
5. The leakage current for all electrical outlets put together should not exceed 2.0 mA.
6. At the time of carrying out the 'Voltage dips & short interruptions immunity' test, flickers were observed in the fluorescent light and UV light whenever the voltage dips and short interruptions were applied on the AC mains port of the cabinet. This condition got rectified automatically after the test. The cabinet is considered to meet performance criteria B in 'Voltage dips & short interruptions immunity test' based on the above observation.

** Pollution degree describes the amount of conductive pollutants present in an operating environment. In Pollution degree 2, it is assumed that only non-conductive pollutants such as dust are present, except that occasional conductivity is caused by condensation.*

*** Installation category (over voltage category) defines the level of transient over voltage that the instrument is designed to withstand safely. It depends on the nature of electricity supply and the cabinet's over voltage protection means. CAT II is a category used for instruments which can be plugged to a power point which is comparable to the public mains found in facilities such as hospitals, research laboratories and industrial laboratories. The expected transient over voltage in CAT II is 2500 V for a 230 V supply and 1500 V for a 120 V supply.*

3.9 PERFORMANCE VALIDATION/CERTIFICATION

After having installed the cabinet but before starting to use it, cabinet performance must be validated and certified to be meeting factory standards. It is recommended that this validation and certification be performed only by a **qualified technician** who is familiar with the methods and procedures for certifying cabinets. The testing methods and equipments needed for carrying out the tests are specified on the test report.

3.9.1 THE IMPORTANCE OF PERFOMANCE VALIDATION/CERTIFICATION

Studies have concluded that an estimated 50,000 to 70,000 workers around the world die each year from chronic occupational diseases resulting from past exposures to toxic substances. (Source: New York Committee for Occupational Safety and Health). Few of the salient points to take note of in this context are:

1. A significant proportion of end-users are largely ignorant, uninformed or simply just not serious enough about the availability of testing, safety specifications and implications of these specifications.
2. Velocity measurement or simple airflow visualization are insufficient for deciding the safety of cabinets.
3. Standardized testing procedures and certification help induce confidence in the tests, besides ensuring safety of the cabinets.

3.9.2 RE-CERTIFICATION

After the initial certification, the cabinet has to be re-certified (please refer to Service Section - Chapter 1, Sub-section 1 for more details) in the event of any of the following eventualities:

1. The cabinet has been relocated
2. The cause of airflow alarm could not be determined
3. There are doubts about the performance of the cabinet
4. Some major maintenance or servicing (filter changing, blower changing etc.) has been carried out

These eventualities apart, the cabinet must be re-certified at least once a year. In the case of cabinets that are used for more critical applications, re-certification should be done as frequently as every 6 months. **Airflow alarm should be re-calibrated strictly subject to the conditions specified in Service Section → Chapter 1 → Section 1.1 → Step 3(b).**

3.9.3 DISCLAIMER

The perfomance and safety of all Esco cabinets are rigorously evaluated at our factory. However we cannot guarantee similar levels of performance and safety after cabinet has been shipped and installed at the user's end because of possible wear and tear during transit. Hence we strongly recommend frequent on-site testing.

3.9.4 REFERENCES FOR QUALIFIED CERTIFIERS

Your nearest Esco distributor

Esco Micro Pte. Ltd.

CHAPTER IV
OPERATING YOUR CABINET

Good work practices are just as important as a good fume cabinet itself in order to achieve effective containment of hazardous agents and samples. This chapter is aimed at providing the users with information on basic operations of this cabinet, besides outlining various recommended work practices, so that they are able to achieve optimal containment from their Esco cabinets.

4.1 SENTINEL® CONTROL SYSTEM

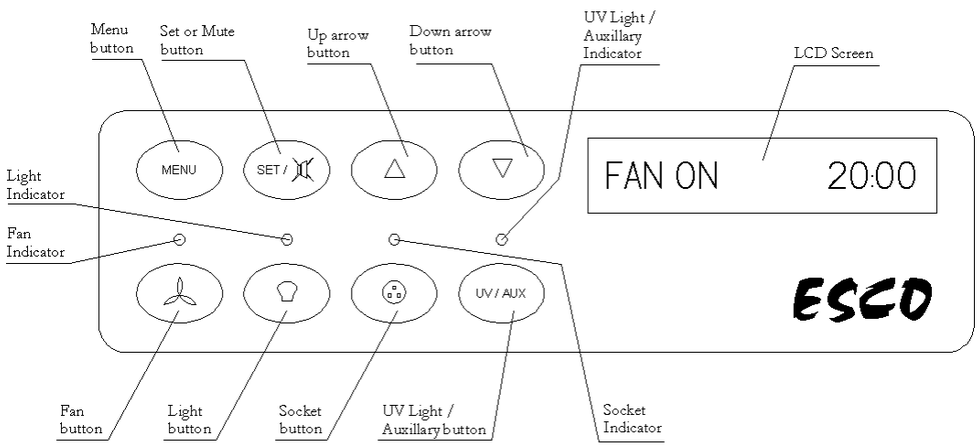


Fig. 6 Sentinel® Keypad User-interface

1. **Fan Button**
   To turn on and turn off the fan
   Refer to **section 4.2.3.2** for information on setting the **Fan PIN**

2. **Auxiliary Button**

3. **Socket Button (although present, this feature is not applicable for PW1).**

4. **Up and Down Arrow Button**
   - To move up and down the menu options
   - To increase and decrease the values of various parameters that can be adjusted under the various menu options
   - To start, stop and reset timer

   Handheld stop watches should strictly be kept out of the work zone as they might be a source of contamination. For timing purposes, a TIMER function has been provided in the user interface and it functions as a stop watch (ONLY in READY state). Time is displayed in HH:MM:SS format. In timer mode, airflow is monitored.

   User can start the timer by pressing the UP arrow button. Pressing UP button again stops the timer. Pressing the UP button yet again would resume the timer counting. Pressing DOWN button will take the user out of the timer mode, and “Timer Reset” message is displayed.

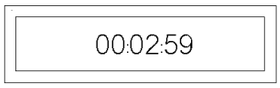


Fig. 9A Screen display when timer is running

Fig. 9B Screen display after timer is reset

Alternatively, the user may use the EXP TIMER function for countdown purposes. This timer has also been implemented for READY state only. Sash position and airflow velocity are monitored in this case too. User can start by pressing the DOWN button. If EXP TIMER is set to "00:00:00", "TIMER NOT SET!" message will be displayed (**Refer to Section 4.2.1.5** for guidelines on how to set the EXP Timer). Timer starts counting down otherwise. Pressing DOWN button again will stop the timer. User can then press DOWN button again to resume the timer. During this time, pressing UP button will take the user out of the timer mode, and “Timer Reset” message will be displayed. Once timer reaches "00:00:00", the "TIMER COMPLETE” and "PRESS UP KEY" message will be displayed with an audible alarm.

5. **Set or Mute Button**
   - To select the menu or sub-menu option currently displayed on the LCD screen
   - To proceed to the next step under a given menu option

Alarm is disabled when you enter menu options

6. **Menu Button**
   - To enter / exit the menu options
   - To go back to the previous level of a given menu option
   - To access maintenance mode from AIRFAIL! error condition

Some of the menu options allow the user to customize the cabinet for a more personalized working experience. Refer to **section 4.2** for detailed explanation on the various menu options.

Before operating the cabinet, please ensure that you have **set the Admin PIN (0000 by default) and Fan PIN (0000 by default). Refer to section 4.2.3.1 and 4.2.3.2 for further instructions.**

The Admin PIN has higher priority and can be used to control the fan (override the Fan PIN) too. **Please contact Esco should you forget your ADMIN PIN.**

4.1.1 SOFTWARE SELF-RESET

Sentinel® is equipped with watchdog timer. The timer runs in the background and detects any possible incidence of software malfunction. Once a malfunction occurs, the timer will reset the system. During system reset (which takes approximately 30 seconds), the cabinet will undergo warm-up cycle; blower would be on but light and electrical outlet would be off. After reset, the system will resume normal operation. Note that no data is erased or reset to the default values.

4.1.2 HARDWARE RESET

Sentinel® can also be reset by pressing RESET button available on the main board; refer to **Product Specification on chapter 2 of SERVICE SECTION** for exact position.

This hardware-reset function can be used in case of controller malfunction, e.g. blank LCD for more than 5 seconds. After RESET button is pressed, the system will restart. Note that no data is erased or reset to default values after hardware reset.

Do not press the RESET button during normal usage as it will disrupt the operation of the cabinet, thereby compromising safety of the operator.

4.2 MENU OPTIONS

When you are entering menu options, the alarm will sound to indicate that the microprocessor is not monitoring the operation of the cabinet and as such will not give airflow alarms. No further warnings will be given. Therefore, it is highly recommended that the user set the ADMIN PIN, which will restrict unauthorized access to the menu. Please refer to section 4.2.3.1 for further details. The default ADMIN PIN from the factory is 0000.

The diagram below illustrates the complete heirarchy of menu options available in this cabinet. Press UP or DOWN button to move through the various menu options. Users are strongly advised to exit the menu options after the requisite adjustment(s) have been made so that any unathorized access to the menu options thereafter can be prevented.

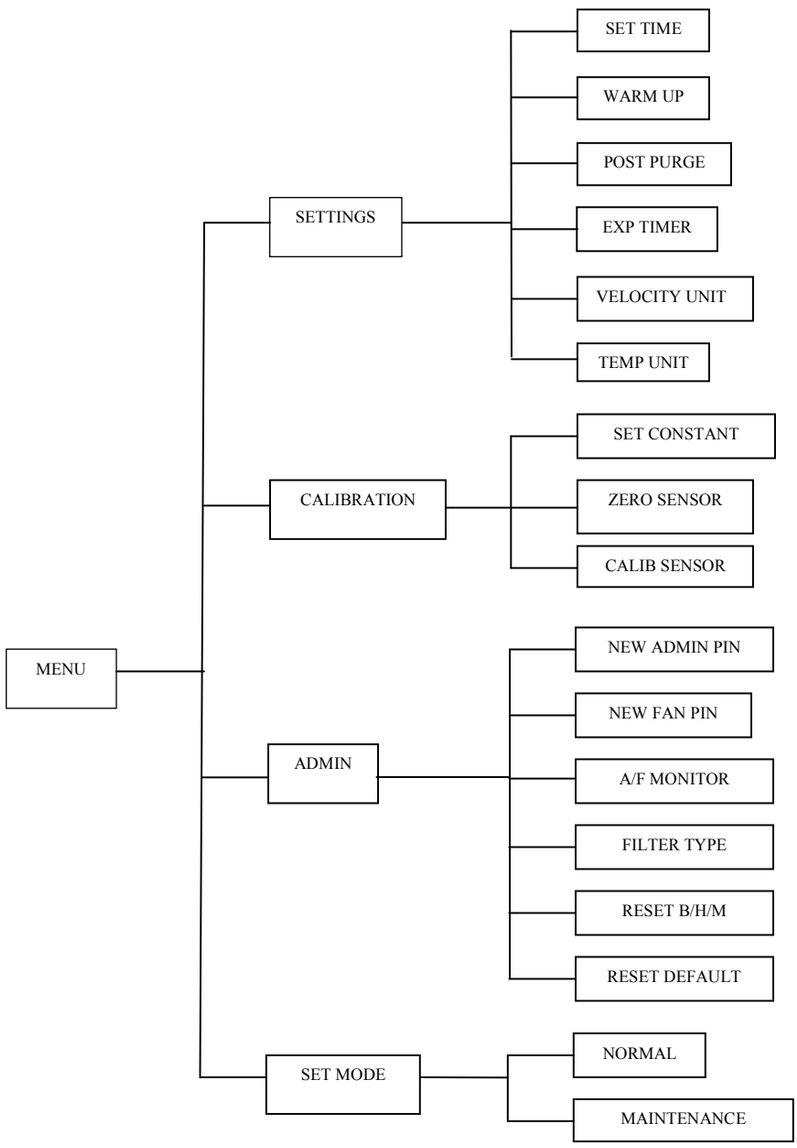


Fig. 10 Hierarchy of menu-options

4.2.1 SETTINGS (CLOCK, TIMER, AND UNITS)

Press SET to enter the SETTINGS menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

4.2.1.1 SET CLOCK (TIME)

Users can set the time by increasing/decreasing the hour and minute values. The time setting is NOT lost even when the cabinet has been switched off.

Press SET button to enter the SET TIME menu. The hour display will blink.
Press UP or DOWN arrow button to choose the correct hour value.
Press SET. The minute display will then start blinking.
Press UP or DOWN arrow button to choose the correct minute value.
Press SET button to confirm the changes.

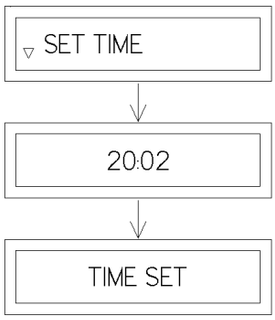


Fig. 11 Display sequence to set time

4.2.1.2 WARM UP TIMER

Before the fan becomes fully functional, there is a time lag for the purpose of 'warm-up'. This is to allow some time to the sensors, fan, and the control system to stabilize. During this time contaminants in the work zone are purged as well. The default warm-up time is 3 minutes but the users can set it to any duration up to 15 minutes.

Press SET button to enter the WARM UP menu. The minute display will blink.
Press UP or DOWN arrow button to choose the correct minute value.
Press SET button to confirm the changes.

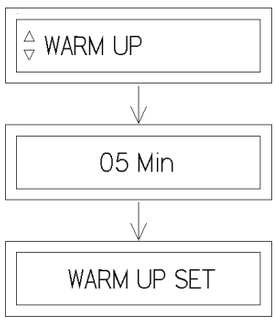


Fig. 12 Display sequence to set warm up time

4.2.1.3 POST PURGE TIMER

After the user switches off the fan, there will be a period of 'post-purge'. During this time all residual contaminants in the work zone are purged. The default 'post-purge' time is 0 minutes but the users can set it to any duration from 0 to 15 minutes. Setting it to 0 minute would effectively amount to disabling this feature. However it is recommended that the post-purge timing be set to at least 3 minutes.

Press SET button to enter the POST PURGE menu. The minute display will blink.
Press UP or DOWN arrow button to choose the correct minute value.
Press SET button to confirm the changes.

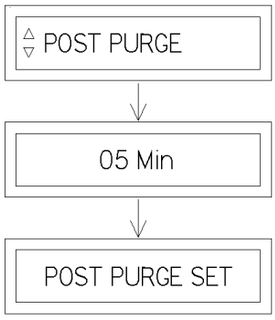


Fig. 13 Display sequence to set post purge time

4.2.1.5 EXP TIMER

To monitor the timing for critical experiments, EXP TIMER menu can be used. It basically serves as a countdown timer. You can set the EXP TIMER to any time period between “00:00:00” and “17:59:59” (HH:MM:SS format).
Press SET button to enter the EXP TIMER menu. The hour display will blink.
Press UP or DOWN arrow button to choose the correct hour value.
Press SET. The minute value will blink.
Press UP or DOWN arrow button to choose the correct minute value.
Press SET. The second display will blink.
Press SET button to confirm the change

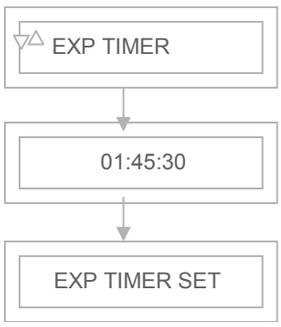


Fig. 14 Display sequence to set EXP timer

4.2.1.6 AIR VELOCITY UNIT SELECTION

Using this option, you can select the unit in which airflow is measured and displayed. You can choose between meter per second (m/s) and feet per minute (fpm). When the fan is running and also during the calibration process, airflow measurement is displayed in the selected unit.

Press SET button to enter the VELOCITY UNIT menu.
Press UP or DOWN arrow button to select the desired measurement unit.
Press SET button to confirm the changes.

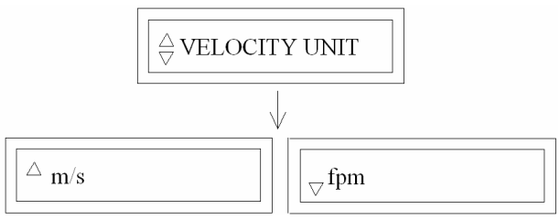


Fig. 15 Display sequence to select Velocity unit

4.2.1.7 TEMPERATURE UNIT SELECTION

Using this option, you can select the unit in which temperature is measured and displayed. You can choose between Celsius and Fahrenheit. The exhaust temperature is displayed in the selected unit.

Press SET button to enter the TEMP UNIT menu.
Press UP or DOWN arrow button to select the desired measurement unit.
Press SET button to confirm the changes.

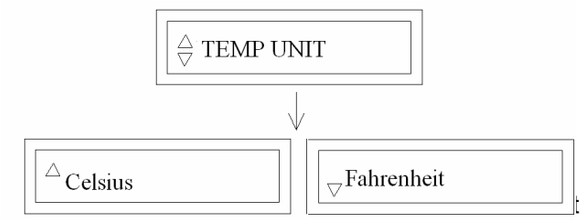


Fig. 16 Display sequence to select temperature unit

4.2.2 CALIBRATION

Press SET to enter the CALIBRATION menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

4.2.2.1 SET CONSTANT

Every sensor manufactured by Esco has a specific Sensor Constant which is used for temperature compensation performed by the temperature sensor. For more information on this option, please refer to Microprocessor Calibration section of the Test Report.

4.2.2.2 ZERO SENSOR

This option is to let the controller record a specific sensor output voltage and correspond it to 0cmh or 0cfm. Please refer to Microprocessor Calibration section of the Test Report for details on how to use this option.

4.2.2.3 CALIB SENSOR

This option allows proper calibration and operation of the airflow sensor alarm. There are two points that have to be calibrated, namely airflow fail point and airflow nominal point. More details on this option can be found in Microprocessor Calibration section of the Test Report.

Calibration must be performed by qualified personnel.
Airflow alarm should be re-calibrated strictly subject to the conditions specified in Service Section → Chapter 1 → Section 1.1 → Step 3(b).

4.2.3 ADMINISTRATOR ACCESS AND PIN

Press SET to enter the ADMIN menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level

4.2.3.1 NEW ADMIN PIN

ADMIN PIN restricts access to MENU functions, including service functions like calibration. After the Admin PIN has been set, one will have to correctly key in the four-digit PIN before being granted access to the MENU. Admin PIN has higher priority and can also be used to control the fan (override Fan PIN).

ADMIN PIN can also be used to switch to Maintenance Mode and AIRFAIL! error conditions. The default PIN is 0000. Setting PIN to 0000 will disable this feature. Please follow the following steps to set a new ADMIN PIN.

Press SET button to enter the NEW ADMIN PIN menu. The first-digit display will blink.
Press UP or DOWN arrow button to choose the desired first-digit of the ADMIN PIN.
Press SET. The second-digit will start blinking.
Press UP or DOWN arrow button to choose the desired second-digit of the ADMIN PIN.
Repeat steps until the fourth-digit of the ADMIN PIN has been chosen.
Press SET button to confirm the changes.

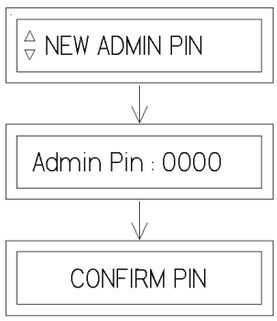


Fig.17 Display sequence to set admin PIN

4.2.3.2 NEW FAN PIN

FAN PIN restricts access to the fan controls. Once the FAN PIN has been set, one will have to correctly key in the four-digit PIN before being allowed to switch the fan on or off. As such, the FAN PIN can be an effective guard against unauthorized personnel operating the cabinet. FAN PIN can also effectively prevent unauthorized shutdown of the cabinet when in fact it needs to be in operation continuously for a prolonged period of time. Please note that continuous operation is recommended for enhanced safety.
It is recommended that the FAN PIN be issued only to personnel authorized to use the cabinet. The default PIN is 0000. Setting the PIN to 0000 will disable this feature. Please follow the following steps to set a new FAN PIN.

Press SET button to enter the NEW FAN PIN menu. The first-digit display will blink.
Press UP or DOWN arrow button to choose the desired first digit of the NEW FAN PIN.
Press SET. The second-digit will start blinking.
Press UP or DOWN arrow button to choose the desired second digit of the NEW FAN PIN.
Repeat steps until the fourth-digit of the NEW FAN PIN has been chosen.
Press SET button to confirm the changes.

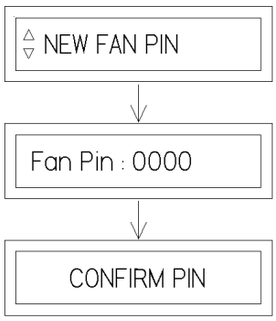


Fig.18 Display sequence to set fan PIN

4.2.3.3 A/F MONITOR

Whenever the airflow falls below the fail point, the air fail alarm is triggered. This option can be used to enable/disable the alarm. By default, this feature is enabled

Press SET button to enter the A/F MONITOR menu.
Press UP or DOWN arrow button to enable or disable the A/F MONITOR.
Press SET button to confirm the changes.

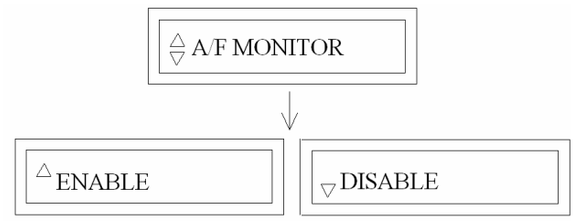


Fig. 19 Display sequence to set alarm setting feature

Disabling the air fail alarm is not recommended during normal operation. However this may be necessary during the installation of exhaust collar or ducting system.

4.2.3.4 FILTER TYPE

This option is to select the different filter type (Standard, Acid, Mercury, Sulphur, Halogen, Aldehyde, and Ammonia).

Press SET button to enter the FILTER TYPE menu.
Press UP or DOWN arrow button to choose the filter type value.

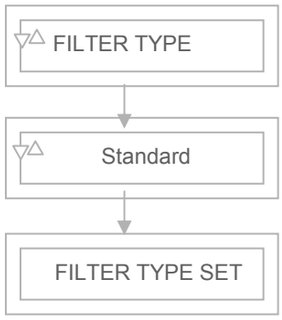


Fig. 20 Display sequence to set FILTER TYPE

4.2.3.5 RESET BLOWER HOUR METER

This option is used to reset the blower hour meter. The blower hour meter keeps a count of how long the blower has been in operation. It can count up to a maximum of 9999 hours. The counter value can be checked while in maintenance mode. You can even draw up the maintenance schedule – including when to change filter - based on the reading of blower hour meter. Please refer to the SERVICE SECTION for more details.

4.2.3.6 RESET DEFAULT

You can reset the default settings/values for few of the parameters discussed above by choosing this option. The features that can be reset are WARM-UP period (factory default setting: 3 minutes), POST-PURGE period (factory default setting: 0 minute), UV TIMER (factory default setting: 0 min), EXP TIMER (factory default setting: 00:00:00), VELOCITY UNIT (factory default setting: m/s), TEMP UNIT (factory default setting: Celsius) ADMIN PIN (factory default setting: 0000), and FAN PIN (factory default setting: 0000). Note that the calibration settings cannot be reset as it may cause the cabinet to operate in an unsafe manner. The hour meters cannot be reset either.

Press SET button to enter the RESET DEFAULT menu
Press SET button to confirm the reset

4.2.4 SETTING THE MODE

Press SET to enter the SET MODE menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

4.2.4.1 NORMAL MODE

This is the default operation mode. When the cabinet is restarted, it goes into this mode by default.

4.2.4.2 MAINTENANCE MODE

This mode should only be used during maintenance by qualified personnel.

The maintenance mode can be used for the following purposes:

1. Calibration/ Performance validation
2. Checking of input/output diagnostics

Please refer to Microprocessor Calibration section of the Test Report for more details.

4.3 STARTING THE CABINET

1. Prepare a written checklist of materials/apparatus necessary for immediate usage.

2. Turn on the blower (default FAN PIN is 0001). Leave the blower on for 3 minutes (default warm-up time is 3 minutes; this setting can be changed though - refer to **section 4.2.1.2**). If the cabinet is just being plugged to the electrical power source, PLS CHECK PANEL message would be displayed; please check that all LEDs and buzzer are on for 6 seconds.

3. Adjust the seating position for optimal operator comfort. It is recommended to use a height adjustable stool. **Refer to section 4.4 on ergonomics** for more information.

4. After all the apparatuses/items have been arranged, allow the blower to run for another 3 minutes in order to purge work zone of contaminants.

5. Minimize room activity (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the cabinet's internal airflow, thereby possibly impairing the containment capabilities of the cabinet.

4.4 WORKING IN THE CABINET

4.4.1 WORKING ERGONOMICS

On most occasions, you would most likely be operating the cabinet in sitting posture. There are some obvious advantages of the sitting posture:

1. The physiological energy cost and fatigue involved in sitting are relatively less
2. Sitting posture provides the body with a stable support

However, sitting position has some drawbacks too:

1. The working area available is fairly limited
2. There is a potential risk of being constrained in the same posture for a long time
3. Sitting posture is one of the most stressful postures for one's back

Therefore you should pay careful attention to the following guidelines in order to achieve comfortable and healthy working conditions:

1. Always ensure that your legs have enough legroom.
2. Keep the lower back comfortably supported by your chair. Adjust the chair or use a pillow behind your back whenever necessary.
3. You should place your feet flat on the floor or on a footrest. Don't dangle your feet and compress your thighs
4. You should keep varying your sitting position throughout the day at regular intervals so that you are never in the same posture for too long.
5. Observe the following precautions with respect to your eyes:
   a. Give your eyes frequent breaks. Periodically look away from the work area and focus at a distant point.
   b. Keep your glasses clean.
6. Arrange the items/apparatuses frequently used in your work in such a way that you can minimize the physical strain involved in handling them.
7. Exercise regularly

Ergonomics accessories available with Esco include:

a. Armrest padding
b. Lab chair
c. Footrest

Please contact your local distributor or Esco for more information.

4.5 CLEANING AND SHUTTING DOWN THE CABINET

1. **As far as possible, it is recommended that the cabinet be operated continuously in order to achieve optimal containment and cleanliness**.

   NB: Airflow studies have shown that once the fan has been switched off, air from the cabinet may escape due to the thermal currents from inside the cabinet. So if you choose to turn off the cabinet, you need to carefully adhere to the following guidelines so as NOT to compromise safety and containment during shutdown.

2. Thoroughly wipe the work surface, side walls, inner back wall using water and some mild detergent. Periodically clean behind the sash window too.

3. Wipe off the detergent using water. Make sure that there are no traces of detergent left.

4. Leave the blower on for 3 minutes in order to purge the work zone. (default post-purge cycle time is 0 minute; this setting can be changed though - refer to **section 4.2.1.3**)

CHAPTER V

MAINTAINING YOUR CABINET

5.1 MAINTENANCE SCHEDULE

COSHH regulations from the UK Health & Safety Executive (HSE) require that equipment to control exposure is properly maintained. It must be thoroughly examined and tested every fourteen (14) months and records kept of this. This 14-monthly period specified suggests annual maintenance with two months grace which is equivalent to Esco annual maintenance schedule.

In view of this, proper and timely maintenance is crucial for trouble free functioning of any device and your Esco cabinet is no exception to this rule. We strongly recommend that you follow the maintenance schedule suggested hereunder in order to obtain optimal performance from your Esco cabinet.

Maintenance work to be carried out weekly

1. Check the alarm and measure the basic airflow (Please refer to the test report for details).
2. Clean the interior work surface and walls with soap water
3. Wipe down sash with appropriate glass cleaner.

Maintenance work to be carried out monthly

1. Inspect the controls of the services to the Powdermax 5 Powder Weighing Balance Enclosure for proper operation.
2. Clean the exterior surface of the fume hood with damp cloth.
3. Determine the face velocity and ensure that ductless fume cabinet is operating at specified face velocity (please refer to Appendix B).

Maintenance work to be carried out quarterly

1. Inspect the fans, motors, drives and bearings for correct operation
2. Check fluorescent tubes and to ensure that they are functioning normally.
3. Check filter saturation (please refer to Appendix A).
4. Measure the face velocity (please refer to Appendix B). Correct as necessary.
5. Test the operation of the airflow alarm
6. Repair defects and lubricate as necessary.
7. For removing stubborn stains / spots on the Phenolic surface, make use of MEK (Methyl-Ethyl-Ketone). In such cases, make sure that you wash the surface immediately afterwards with clean water and some liquid detergent. Use polyurethane cloth or sponge for washing. Regularly cleaning the phenolic surface would help you retain the attractive factory finish.

Maintenance work to be carried out annually

1. ***Have the cabinet recertified by a qualified certification technician***.
   For more information, refer to Chapter III section 3.4 on performance validation/certification
2. Quarterly maintenance prescribed above.

Maintenance work to be carried out biannually

1. Replace the fluorescent lamps
2. Annual maintenance prescribed above.

SERVICE SECTION

CHAPTER I

RE-CERTIFICATION AND MAINTENANCE BY SERVICE PERSONNEL

1.1 AIRFLOW VERIFICATION & CABINET RE-CERTIFICATION

Re-certification must be performed during any of the following eventualities:

1. New installation
2. Relocation of the cabinet
3. The cause of activation of airflow alarm cannot be determined
4. Dubious performance of the cabinet
5. At least once in a year

Please refer to the test report for detailed description of method and equipments required for performing the certification testing. The original test report has been packed along with this manual. A copy of the test report is inside the plastic bag pasted adjacent to the electrical control panel.

Steps to perform certification:

1. Turn on the cabinet for **≥10 minutes** to allow the speed control to reach 99% of the target voltage output.

2. Check the nominal inflow values in the test report. Check if the corresponding values displayed on the LCD are within +/- 0.02 m/s of the values in the test report. If yes then you may proceed to Step 3, or else proceed to step 2a:

    a. Open the electrical control panel.

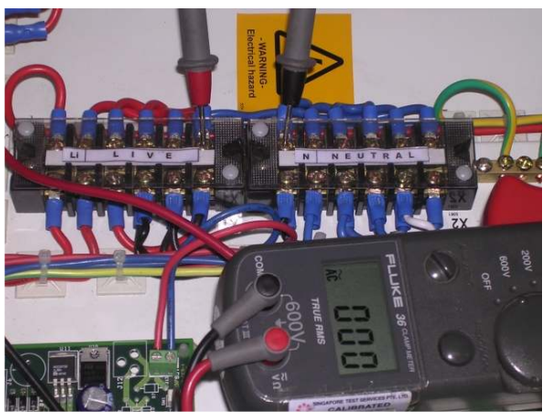
b. Plug the voltmeter probes to the Motor Voltage Sampling Port, as indicated by the white circle in the pictures below.

For both 115V / 230V models

Plug the voltmeter to the blue and red (old model is blue and black) wires joined by a white open-end connector.

Adjust the speed control by turning the knob of the speed controller

c. If the motor voltage differs from the Nominal Motor Voltage mentioned in the Test Conditions Documentation Sheet of the Test Report, the speed control would need to be adjusted so that the motor voltage matches the Nominal Motor Voltage in the Test Report. Your building supply voltage may differ from the supply voltage at the Esco Test Lab. This supply voltage difference will roughly double the blower voltage difference, creating a more significant airflow discrepancy. To measure the building supply voltage:



Building supply voltage of 230 V cabinet
Plug one voltmeter probe to the LIVE terminal block (red wires), and the other probe to the NEUTRAL terminal block (blue wires)

For example:

	Esco factory	Your laboratory
Building supply voltage	230 V	220 V
Motor (blower) voltage	135 V	118 V

In this case, the motor voltage must be increased from 118 volt to 135 volt by turning the speed control clockwise in order to match the given motor voltage at the Esco factory. Please note that the difference between the motor voltages is always greater than the difference between the building supply voltages. Therefore, in this case, it is not enough to increase the motor voltage just by 10 volts (which is the difference between the building supply voltages). Rather it needs to be increased

by 17 volts.

3. Using thermo-anemometer, check the inflow velocity of the cabinet to make sure that:

   a. The inflow velocities vary from the nominal point given in the test report by no more than 0.025 m/s. If the deviation is more than 0.025 m/s, adjust the speed control to get the nominal inflow setpoint. If either of nominal inflow cannot be achieved by speed control adjustment, then the cabinet would need re-balancing.

   b. The inflow velocities are within 0.02 m/s from the velocity values displayed on the LCD. **If and only if the velocity values displayed on LCD vary by more than 0.02 m/s from the actual inflow and down flow velocities, the microprocessor would need to be re-calibrated.** Please refer to the Microprocessor Calibration section of the Test Report.

4. Perform the filter retention efficiency (filter saturation test). Please refer to Appendix A.

5. Perform site installation assessment test

6. You are recommended to perform the following optional tests too:

   a. Operator comfort tests: light, noise, and vibration

   b. Electrical safety test

Esco conducts training courses on the validation and certification of fume cabinets. If you are interested you are most welcome to contact Esco Micro Pte Ltd or your nearest Esco distributor.

1.2 CALIBRATION OF SENTINEL™ CONTROL

The purpose of calibrating the controller is to let the controller record particular output voltages from the airflow sensor and correspond them to fail and nominal points of air velocity. Once the calibration has been completed, the control will be able to show the air velocity whenever the fan is in operation. All Esco cabinets are factory-tested and calibrated before being shipped.

Calibration is required in the following eventualities:

- The cause of airflow alarm cannot be determined
- At the time of annual re-certification

Please refer to the calibration section of the test report for the details on steps involved in calibration, equipments needed for carrying out calibration and other testing procedures. The calibration must be done in the maintenance mode.

1.2.1 Sentinel control display in maintenance mode

DISPLAY	DESCRIPTION
C203 V2.0	Software version
M.: Maintenance	Mode
FAN: ON/OFF	Fan status
WARM UP: XX	Warm up time
PURGE:XX	Purging time
B/H/M:XXXX	Blower hour meter
F/C/D: XX-XX-XX	Year (04-32), Month (0-12), Day (0-31)
LIGHT: ON/OFF	Light status
A/F MONITOR:D/E	Airflow monitor status (enable or disable)
ADC A/F : XXXX	ADC value of current air-velocity sensor
ADC ZERO: XXXX	ADC value of airflow zero point
ADC FAIL: XXXX	ADC value of airflow fail point
ADC OPTM: XXXX	ADC value of airflow optimal point

ADC TEMP: XXXX	ADC value of temperature sensor
TEMP : 00 °C/F	Current temperature (Celsius or Fahrenheit)
CONSTANT: 050	Temperature compensation formula constant

ADC stands for Analog to Digital Conversion

1.3 SOFTWARE UPDATING

Esco sometimes releases upgraded versions of the Sentinel® control's embedded software. The upgraded version can be downloaded from our website using a toolkit that can be purchased from Esco at a nominal cost.

You do not have to compulsorily upgrade your Sentinel® control's embedded software unless it is for safety considerations. You can download the software upgrades from http://biotech.escoglobal.com/support/sentinel

WARNING: SOFTWARE UPDATE PROCEDURE WILL CAUSE CALIBRATION DATA TO BE ERASED FROM YOUR SYSTEM. ENSURE THAT THE SYSTEM IS RECALIBRATED AFTERWARDS

1.4 REPLACEMENT OF FILTER

Under normal usage and barring any accident (example - puncture), the filter do not need replacement unless and until the inflow velocity cannot be maintained at the specifications required by the testing report even though the fan has been set to maximum speed.

1. Ensure that the motor is shut off first
2. Lift the head unit and lock it in place by using the stoppers
3. Lift & pull out each of the carbon filter unit from the filter bank
4. Unpack the new carbon filter & install it into the filter bank
5. Repeat the procedure in reverse order to complete the replacement.

Used filter is contaminated with chemical vapours and so should be sealed in a plastic bag for disposal in accordance with local regulations. Please refer to SAFETY WARNING in Page 4 for more information.

1.5 REPLACEMENT OF FLUORESCENT LAMP

1. Check the replacement parts list at the end of this manual
2. Disconnect the electrical connections
3. Lift the head unit and lock it in place by using the stoppers
4. The fluorescent lamp(s) are located behind the blue panel. Remove the old one(s) from their socket(s) and replace back with the new one(s)

The use of non-Esco parts and/or parts not supplied directly by Esco or our authorized distributors, including but not limited to maintenance parts, spare parts, replacement parts, system components and/or system accessories shall void all expressed or implied warranties.

CHAPTER II

PRODUCT SPECIFICATION

CONTENTS:

Engineering Diagram of All Models of Different Sizes

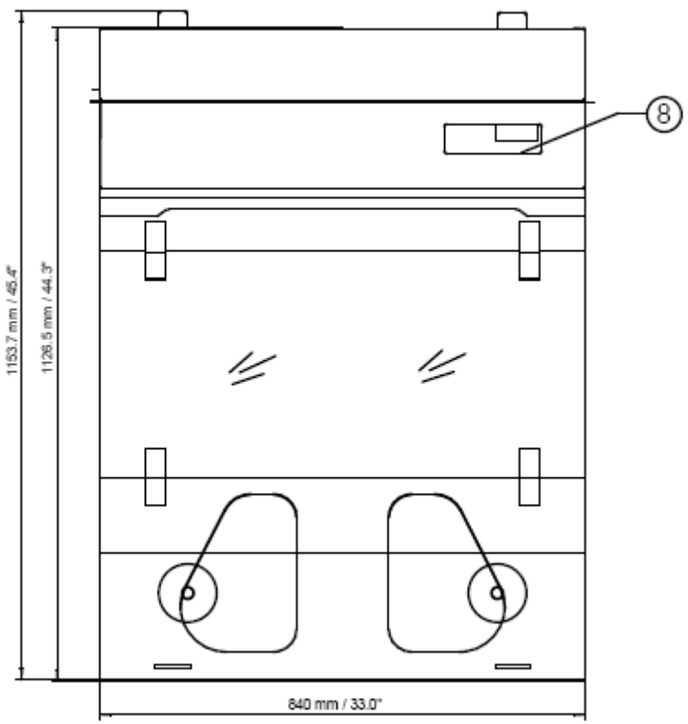
Technical Specification Summary Table

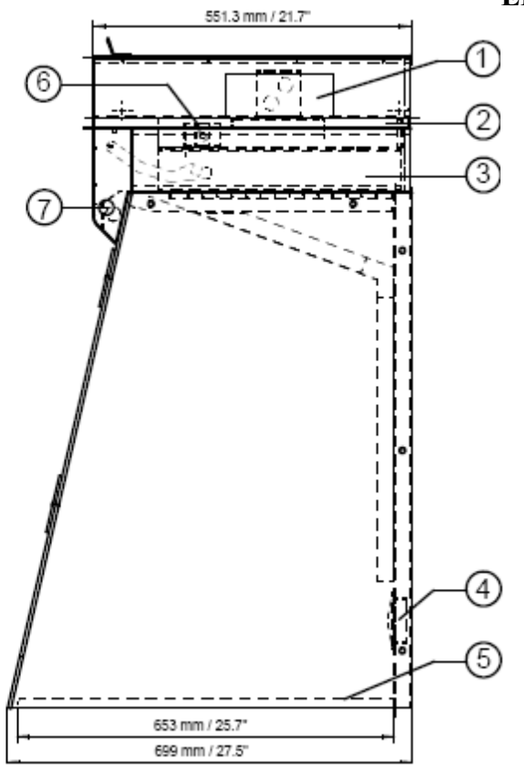
Microprocessor Specification

Electrical Schematics of Each Power Rating Variant

All features and specifications are subject to change without any prior notice.

2.1 Engineering Details





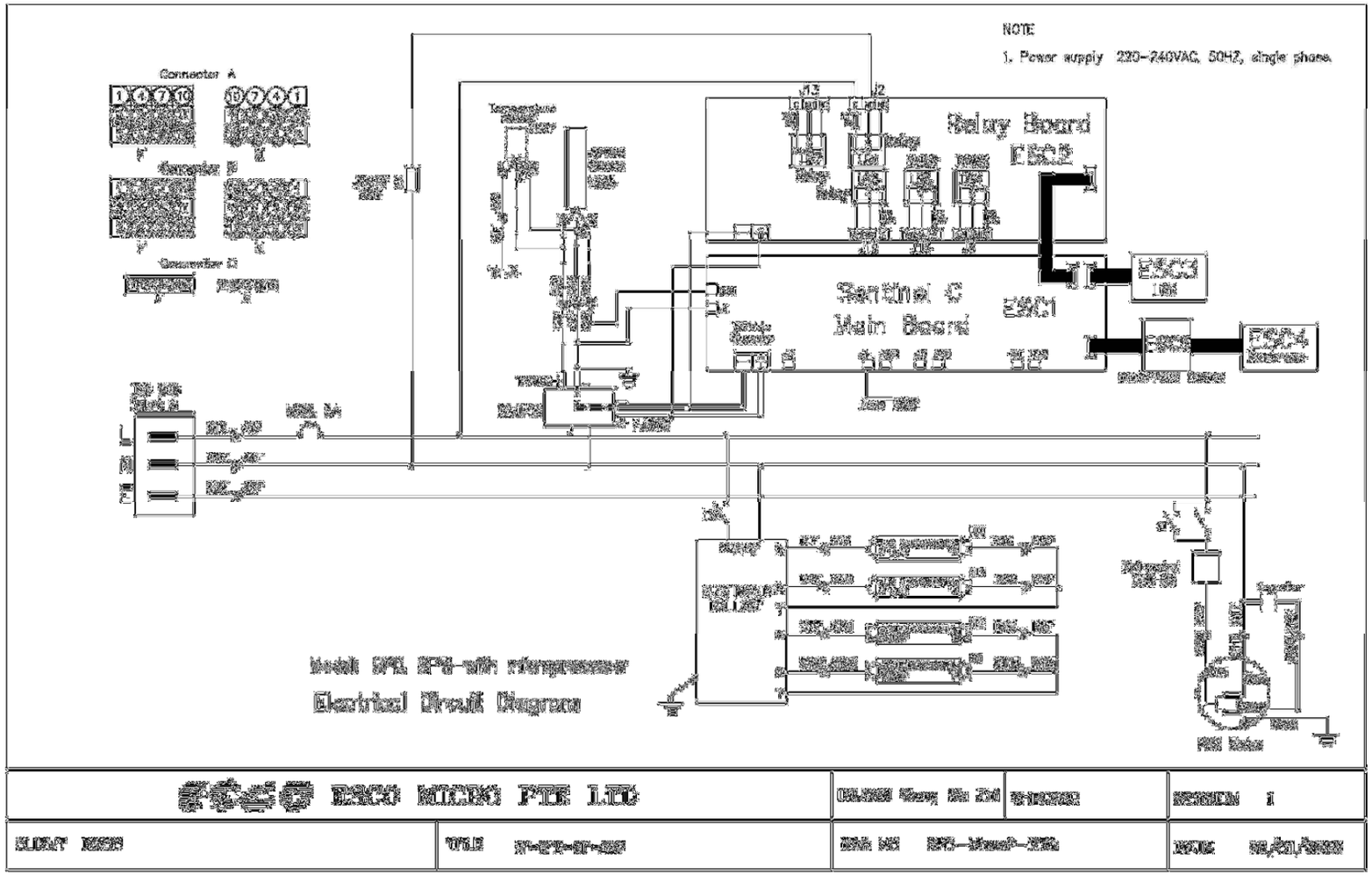
ENGINEERING DETAIL

1. BLOWER
2. ELECTRICAL PANEL
3. HEPA FILTER
4. SERVICE FIXTURE HOLE COVER
5. PHENOLIC WORK TOP
6. SENSOR BOX
7. FLUORESCENT LIGHT
8. OPERATING MICROPROCESSOR SWITCH

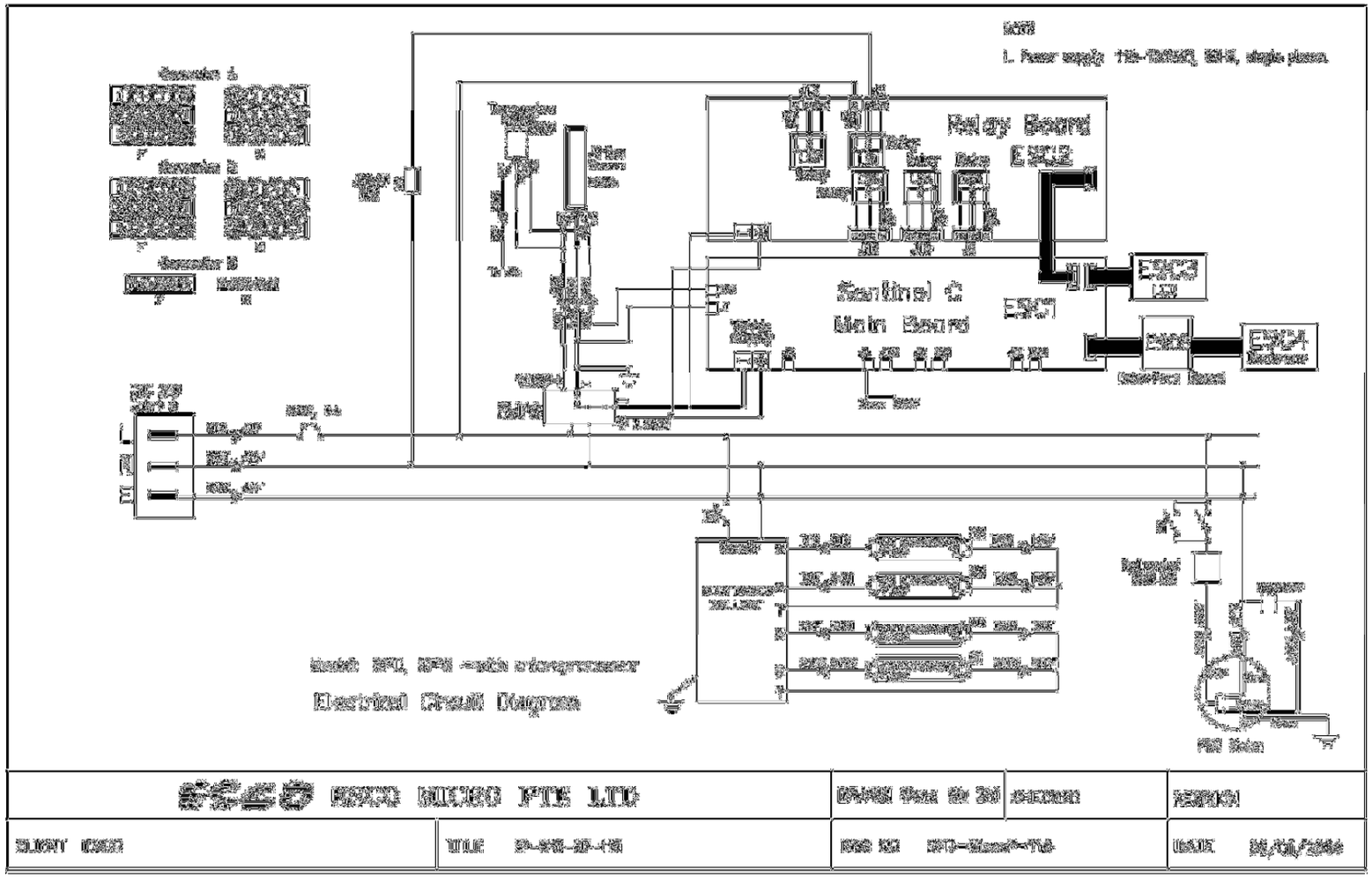
2.2 Technical Specifications

General Specifications	PW1 – 3A1
External Dimensions (Width x Depth x Height)	840 mm x 693 mm x 1127 mm 33” x 27.3” x 44.3”
Air Volume (At Initial Velocity)	234 cmh / 138 cfm
Inflow Velocity	Initial setpoint: average of 0.4 m/s or 80 fpm measured in plane of work aperture
Standard Filtration Element	HEPA Filter
Noise Level	<57 dB at initial blower speed setting measured at typical operator work position
Light Intensity	>300 Lux at work surface level
Construction	**Main Body & Internal baffle system:** 1.2 mm/ 0.05”/16 gauge electro-galvanized steel with white oven-baked epoxy powder-coating finish **Front panel and side panels:** 6 mm/ 0.2” Acrylic
Power Supply	**Choose from the following power supply configuration codes when ordering** **1.** 220-240VAC 50Hz **2.** 110-130VAC 60Hz **3.** 220-240VAC 60Hz **4.** 110-130VAC 50Hz **5.** 100-110VAC 50Hz/60Hz
Power Rating	225W (230VAC units) 270W (115VAC units)
Max. Shipping Dimensions (L x W x H)	956 x 864 x 560 mm 37.6” x 34” x 22”

2.3 Electrical Schematic (230V)



2.4 Electrical Schematic (115V)

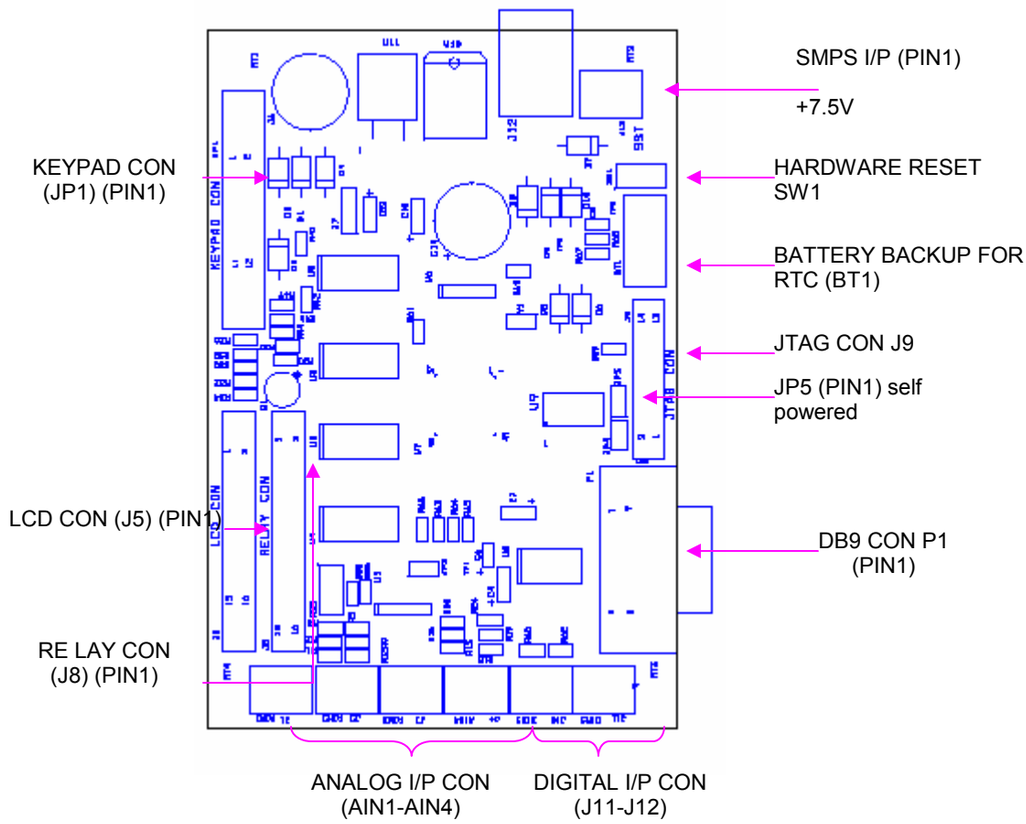


2.5 SENTINEL CONTROL SYSTEM

Mains Input Voltage: 100-240VAC
Mains Input Frequency: 50/60Hz
Sentinel® Control Input Voltage: 7.5VDC
Max input current: 500mA
Electromagnetic interference

Hardware requirement:

- PSC, backward curve fan
- Fluorescent light and ballast
- Sentinel® Control, comprising of main board, relay board, interface board, and 1x16 LCD screen
- Airflow sensor, Input 12VDC
- Temperature Sensor, Input 12VDC
- Keypad and dual output SMPS



Picture 16: Top view of Sentinel® main board with components

CHAPTER III
TROUBLESHOOTING

This section helps you troubleshoot some of the common problems you might face while operating this cabinet. Should you have any queries left unanswered here, please feel free to contact Esco.

3.1 ELECTRICAL AND MECHANICAL TROUBLESHOOTING

Warning

Electrical hazard. Please study the electrical circuit diagram carefully before you start using this cabinet. You can find the electrical diagram inside the electrical panel which in turn is behind the front panel.

Problem	Possible Causes	()Corrective Action
Cabinet does not start	Power failure	Check if there is power at the wall socket If circuit breaker has tripped, please check electrical components and connections before resetting the breaker.
	Wrong electrical connection	Check whether electrical cord has been connected properly
		Check if the SMPS output is 7.5VDC at its output terminal. If no voltage, please check the incoming power supply to the SMPS. If the output voltage of SMPS is less than 7VDC, replace the SMPS
		Check whether there is 7.5VDC supply to the main board. Using multimeter, probe J13 on the main board (terminal nearer to the edge of the board is the negative terminal)
		Check whether there is 7.5VDC supply to the relay board. Using multimeter, probe J1 on the relay board (terminal nearer to the edge is the negative terminal)
	Spoilt Main Board	Restart the cabinet several times. If the following three conditions persist, you should know that the main board is spoilt: 1. All LEDs on the membrane are always off 2. LCD displays nothing 3. No sound from Relay Board **Please replace the main board**

	Spoilt Relay Board	You should know that the relay board is spoilt if you observe the following conditions: 1. Main Board is working properly 2. FRC cable between main board and relay board is properly installed 3. All the connectors and fuses have also been connected properly and are in good working condition 4. However neither amongst FAN, LIGHT or SOCKET can be controlled **Please replace the relay board**.
Motor is silent	Fan is Off	Please switch on the FAN by pressing the FAN button. Enter the FAN PIN if required. The green LED above the FAN button will illuminate.
	Blown fuse	• Switch off the cabinet. • Check for fuse F1 on the relay board. If the fuse has blown, replace it with a new one. Temporary solution: take out fuse F5 and put it in place of F1.
	Faulty relays	1. Switch off the cabinet. 2. Check LS1 relay on the relay board. Ensure that C-NC connection is closed and C-NO open. 3. Check K1 relay mounted on the electrical box. Ensure that C-NC connection is closed and C-NO open. 4. Replace the faulty relay(s).
	Faulty speed control	• Short out the control by connecting a jumper wire across the leads of the two speeds control. • If the fan operates properly, you can conclude that the speed control is defective. Call your distributor for replacement. • If the fan does not operate, the problem is not with the speed control.
	Auto-thermal cut-off (built-in)	1. Overheated Blower. 2. Wait for 30 minutes and try again. Ensure that no hazardous materials are there inside the cabinet. 3. Replace blower if problem persists.
	Motor failure	1. Disconnect the two motor leads and connect an AC voltage source directly to the motor. 2. If the motor starts to run, the problem is in the wiring. Refer to blown fuse or faulty relay sections. 3. If the motor does not run, the motor is defective. Replace the motor.
	No airflow, burning smell and possibly a humming noise too → Faulty capacitor	Disconnect and measure the capacitance, replace faulty capacitor.

Blank LCD	Connection problem	Check whether LCD FRC connector has been inserted properly into its socket on the main board.
	Contrast problem	Adjust the potential meter (next to the connector to Relay Board) on main board to achieve the best contrast.
	Spoiled LCD	Connect a working LCD to the LCD port of main board. If the working LCD functions properly, you should know that the old one is spoilt. Replace the old one.
Inoperative buttons	Connection problem	1. Check if the green plastic cable from the keypad has been inserted properly into the interface board. 2. Check if the interface board has been connected to the main board through a FRC connector. The triangle sign on the female connector indicates that PIN is corresponding to PIN 1 of male connector.
	Spoiled Cable and / or Interface Board and / or keypad	Replace them one by one, to check which one(s) amongst them is/are spoilt. Replace the spoilt one(s) with one(s) that are new/working.
Airflow Failure - alarm is triggered (this could be due to either hardware or software)	Low building supply voltage	• Using multimeter, probe the motor voltage sampling port as described in the re-certification section of this manual. This is to measure the blower's supply voltage. • If the building supply voltage is lower than the test report value, adjust the speed control to get blower output voltage as specified in the Test Report – Test Conditions Documentation Sheet
	Fluctuating Voltage	If the building supply voltage fluctuates more than the stated tolerance (+/- 2%), connect the cabinet to a voltage stabilizer.
	External air interference	Ensure that there are no external sources of airflow disturbance like air conditioner vent, window or incidences of door opening or people walking fast near the cabinet.
	Sensor Failure / Sensor Misalignment	<u>Air Flow Sensor failure / misalignment</u> 6. Check the sensor connection. 7. **Important:** Ensure that the sensor is not blocked at all and that its through-hole is perpendicular to the filter's surface. 8. Using multimeter, check the sensor's output voltage at channel AIN1 and J1. The voltage should increase with increase in airflow. Replace the sensor if your observation is otherwise. 9. Call your distributor if the problem is still not solved <u>Temperature Sensor Failure</u> 1. Check the sensor connection 2. Using multimeter, check the sensor's output voltage at channel AIN4 and J4. 0.01V should represent one degree Celsius. Replace temperature sensor if your observation is otherwise.

	Motor failure	Check the motor. Refer to 'motor silent' section
	Filter loaded	Plug in the multimeter to the Motor Voltage Sampling Port. Turn the Speed Control to increase the blower voltage by approximately 10 volts until the alarm is turned off and the LCD shows nominal airflow reading. The sensor will take about 1-2 minutes before it can register a new airflow setting. **Note: The cabinet must be certified at least annually.** If the blower is already operating at maximum voltage and the airflow alarm is triggered, it's time to change the filter.
	Faulty/ inaccurate calibration	Re-calibrate the microprocessor. **Warning:** To be carried out only by an authorized person.
	Others	Please refer to software troubleshooting section for more information.
Excessive fan noise	Loose motor or impeller wheel mounting	1. Check if the screw holding the impeller has been fully tightened. Check if all the impeller and motor mounting bolts have been fully tightened. 2. Check the capacitor, and replace if necessary.
Light always OFF	Faulty relay	Check LS7 relay and fuse F7 on the relay board. Replace the fuse if it has blown. Ensure that C-NC connection is closed and C-NO open. Replace the faulty relay board. Call your distributor for details.
	Connection Problem	5. Check the connection between relay board, fluorescent lamp ballast and female connector at the side of the electrical box. 6. Check the connection of the lamp holder.
	Faulty light	Replace the faulty light.
Electrical Socket always OFF	Faulty relay	Check LS4 relay and fuse F4 on the relay board. Replace the fuse if it has blown. Ensure that C-NC connection is closed and C-NO open. Replace the faulty relay board. Call your distributor for details
	Connection Problem	1. Check the connection between relay board and female connector at the side of the electrical box. 2. Check the connection of the socket
	Faulty electrical socket	Replace the electrical socket

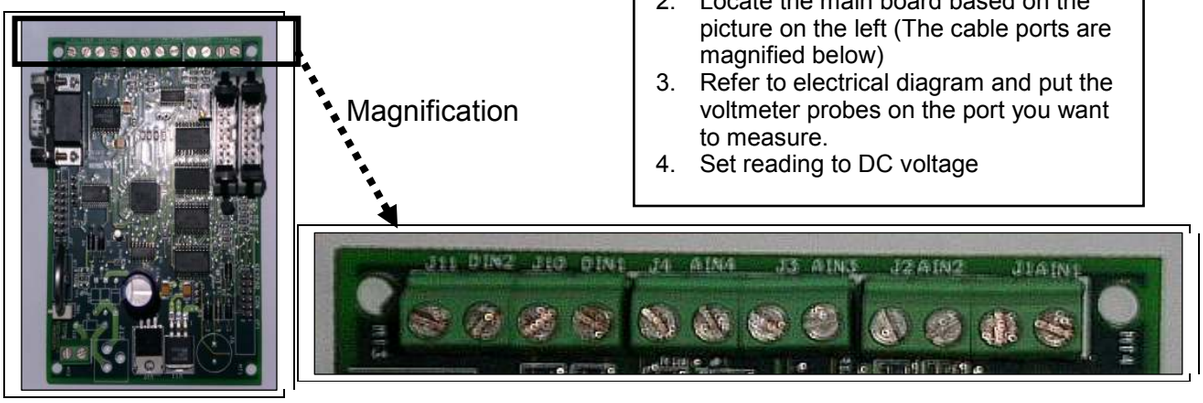
ADDITIONAL NOTES ON AIRFLOW ISSUE DUE TO SUPPLY VOLTAGE AND FREQUENCY

Where the actual supply voltage or frequency on site differs from test conditions at the Esco factory, small deviations *within the allowed operating conditions (blower voltage difference of not exceeding 2%)* will not have any detrimental effect on the cabinet's performance and thus the user need not necessarily re-adjust the speed control. However the user can still compensate for any such difference in the following ways:

a. If the cabinet is brand-new, the filter unused (clean filter) and the on-site supply frequency same as what was recorded above, then the user can re-adjust the speed control to ensure that the motor voltage (measured with a voltmeter) corresponds to the value recorded in Test Report – Test Conditions Documentation Sheet

b. If the cabinet has been used for some time (filter starts to get loaded with particles), or if supply frequency and/or supply voltage differ from the values recorded in the Test Report, then the user may adjust the speed control until the LCD displays the optimum airflow as indicated in the Test Report – Sentinel™ Calibration Sheet. Note that the Esco Sentinel™ system should be allowed to “warm-up” for at least 10 minutes before the speed control adjustments are made.

Checking the Sensor Output



1. Open the electrical panel box.
2. Locate the main board based on the picture on the left (The cable ports are magnified below)
3. Refer to electrical diagram and put the voltmeter probes on the port you want to measure.
4. Set reading to DC voltage

3.2 SOFTWARE TROUBLESHOOTING

Error Codes	Explanation	Corrective Action
ERR.AIRFAIL	Airflow Error: This error occurs if the FAN button is pressed at a time when airflow has dropped below fail point. Switch on FAN again and wait for it to be stable before troubleshooting	6) Check the inflow velocity using anemometer If the inflow has indeed dropped below the fail point (see Calibration section for the exact value), adjust the speed control to achieve blower output voltage as stated in the Calibration certificate. WARNING: This step should be carried out only by an authorized person 7) If the inflow still above the fail point, a. Press menu and key in ADMIN password to switch to MAINTENANCE mode b. Press SET button to read diagnostic message. c. Check whether the Constant and Temperature values are correct. If Constant value is not correct, please change it to factory setting. If temperature value is incorrect, please check the wire connection and temperature sensor. Call your distributor to replace spoilt parts (if any). d. Check the wire connection and air-flow sensor. Call your distributor to replace spoilt parts (if any) WARNING: This step should be carried out only by an authorized person
ERR.CALIB	Controller has not yet been calibrated	Calibrate the controller. Refer to Calibration section for details. WARNING: This step should be carried out only by an authorized person

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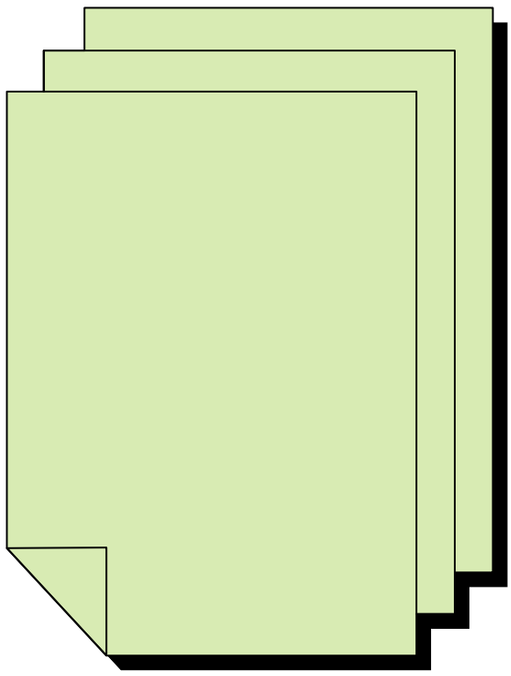

APPENDIX

APPENDIX A

MEASUREMENTS OF FACE VELOCITY TEST

Note: Do note that our factory face velocity test provided in our test report is based upon the ASHRAE standard which uses more extensive equipments. The following face velocity test however is based upon the COSHH (HSE) which is provided here for your general on-site testing. Please consult your distibutor if you wish to conduct the face velocity test based upon the ASHRAE standards.

SECTION A: PROCEDURE

1. Do not attempt measurements on a windy day. It is best if doors are not being opened and shut elsewhere in the building.
2. Arrange the ventilation of the room so that it is most unfavorable to extraction by the fume cupboard concerned
3. Remove everything from the fume cupboard so that the air flow is not obstructed by objects.
4. Do some quick air flow measurements to see if, with the sash at maximum height, the minimum face velocity is likely to be over 0.3 ms^{-1}. Set the sash to its normal operating height.
5. Record this sash height.
6. Imagine the face of the Esco Powdermax 5 Powder Weighing Balance Enclosure divided into nine equal rectangles. Stand as far as practicable from the fume cupboard with the sensing heading in the plane of the sash and take air flow reading at approximately the centre of the nine rectangles.

a	b	c
d	e	f
g	h	i

7. Record for each rectangle the approximately average reading over a period of at least ten seconds.
8. Look at the table and repeat any reading which seems to be very difference from the general pattern. Record the average of this and the previous reading.

SECTION B: CALCULATION

Minimum face velocity

Record which of **a, b, c, d, e, f, g, h, i** is the smallest

Is the value above or below 0.3 ms^{-1}? If it is below, the Balance Enclosure fails.

Variation

Add **a, b, c, d, e, f, g, h, i,** and divide by 9 to get the average.

Find the biggest and smallest value of **a, b, c, d, e, f, g, h, i**.

Calculation: Biggest minus average. Divide the answer by average and multiply by 100 to obtain the lower percentage variation.

Is each of these less than 30%? If not, the Balance Enclosure does not meet the recommendation and, if a new installation, should not be accepted.

The variation in favourable conditions should be below +/- 20%. However, because it is difficult to find ideal sites in many laboratories, +/- 30% has been stipulated.

APPENDIX B

REFERENCE MATERIALS

WEBSITES

1. http://www.acgih.org/
   American Conference of Governmental Industrial Hygienists (ACGIH)

2. www.escoglobal.com
   Esco Micro Pte. Ltd.

4. http://www.cdc.gov/niosh/homepage.html
   National Institute for Occupational Safety and Health (NIOSH)

5. http://www.osha.gov
   Occupational Safety and Health Administration, USA

6. https://www.aiha.org/
   The American Industrial Hygiene Association (AIHA)

DEFECT REPORTING FORM

To submit your warranty claim or to obtain a Return Authorization (RA) number, please complete this defect reporting form and return it to Esco by fax or postal mail.

PRODUCT INFORMATION

Model Number : _____

Serial Number : _____

Date of Purchase : _____

CUSTOMER INFORMATION

Company : _____

Address : _____

: _____

Telephone : _____

Fax : _____

Email : _____

NAME OF ESCO DISTRIBUTOR

Contact : _____

Company : _____

Country : _____

BRIEF DESCRIPTION OF ERROR

_____

_____

_____

_____

WHEN DID THE ERROR OCCUR*

Transport Damage / Unpacking / Assembly / Routine Operation

RETURNING PRODUCTS/PARTS*

Under Warranty / For Service or Repair / For Replacement / Credit Note Requested

Name/Date: _____ Signature: _____

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